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BLUE JAY

December 1996

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EDITOR'S MESSAGE

Pulling together my second issue of *Blue Jay* was a little less frantic than the first! If all goes according to plan this issue will reach you early in the New Year and the March issue will come out by April. By then we should be back to the original publishing schedule. Staying there will depend as much on you as on me. I need articles. For some reason I have never understood why bird enthusiasts are more prone to write than other naturalists. I implore those of you who look for plants, photograph insects, study mammals or any other part of nature to put pen to paper. We could also use more discussion of subjects like habitat change, management practices, new industrial developments and the impact of farming methods.

I would like to have more photographs on file. We plan to include some photographs for their own value and beauty in each issue, so if you have one of which you are particularly proud, share it with us. We want to try using the entire cover for photographs too. This means the photograph should fill both pages, but the centre of interest must be on the right. See the December 1993 issue for a fine example of this type of cover — a fox asleep on a snow bank.

We intend to present a summary of recent observations in each issue. What we include again depends on you. Send me a note of your observations so that I can incorporate them in the observations section. We expect that bird observations may dominate because more people watch birds, they are more visible and they are more likely to occur as rarities. My intent, however, is to include **all** aspects of nature. Again I challenge the "non-birding" naturalists to send a note or phone with their unusual observations. This is another section where we can include photographs if we have them on file.

Finally, I want to try a section on the "Practical Naturalist." This could include articles on the best types of bird feeders and bird houses, experiences with different types of seed, plants that grow well in our climate and attract butterflies or birds, bat house designs, ponds for frogs, new binoculars and telescopes, camera tricks etc., etc. Do we have any volunteers?

Once again, I want to thank those people who helped me with this issue. In particular, I want to thank Frank Roy for a heroic effort in editing the final draft, my wife, Stephanie, for typing all of the submitted written material and Gail Bunt for her conscientious effort in producing the index.

Sincerely,

Roy D. John

BIRDS

CHICKADEES

DAVID G. MILLER, 515 Gabriel Road, Grasswood, SK. S7T 1A9

This is the original of the article that was adapted for "Nature Notes" in the Saskatoon Sun.

My wife's crazy. Well, a bit unrealistic, anyway. It's not her fault, really, city-born and an Easterner, Cathryn has made admirable progress since we settled near Saskatoon. The way she shakes her head at rainless skies and damns the railroads, you'd never guess she was born in Toronto. It's in matters concerning the birds that she shows she's not quite in touch with reality, so when a very bold bunch of chickadees began to visit our feeder ten years ago and she announced, "I want them to sit on my finger," my response was a patronizing smile and a confident, rational prediction of failure.

Undaunted, Cathryn chose a morning in February when the chickadees had emptied the feeding station, and stationed herself beneath the feeder with an outstretched bare hand ("I want to feel their toes") full of sunflower seeds. And there she stood.

From time to time I glanced pityingly at her through my workshop window and wondered how long this futile foolishness would last; it was not a cold day for February, but it *was* February. The chickadees chirped their displeasure from the tree above her, and checked the feeder bowl with increasing indignation. Cathryn's shivering was visible from the far side of the yard.

Forty-five minutes had passed; I had given up waiting for her to give up, and was concentrating on my wood-work, when the door of the shop burst open and my red-nosed spouse announced through chattering teeth, "Chickadees are so small they don't weigh anything when they land on your finger!" She was right, and when I finally got a turn at feeding them, I found the pinch of tiny claws enthralling, and the apparent weightlessness of the little black and grey fluff-balls a source of wonder and delight.

We had two regular chickadees that winter, and came quickly to distinguish them by behaviour — Brash was always the first in when called, flying straight to the proffered hand, picking over the seeds at leisure, and then flying off with the two largest ones he could find. Buddy was more hesitant, always landed on a nearby branch to assess the situation, and then darted in, grabbed a seed, and shot away to hammer off the shell in the safety of a tall tree.

The next year they were joined by a smaller colleague (their offspring, we assumed), a remarkably dumb little bird we named Bonzo in honour of his clowning. Bonzo would perch on people's toques, fly up their sleeves, or hang *underneath* a hand that held food, pecking at knuckles and fingernails and asking bitterly where we had hidden the damned seeds!

Numbers grew; soon we had a regular winter flock of greedy and indistinguishable birds that would pursue guests from their cars to the door of the house demanding seeds. Charming though they seem to us, chickadees are aggressive and belligerent little birds with each other, and when one tiny bird appeared with his head bleeding and pecked bare of feathers, we suspected he had tried to push his way too far into the lineup for the feeder, and had paid a high price for his foolishness. We called him Ratbag, for he truly looked gnawed. He survived his mauling and, bellicose bird that he was, quickly became dominant in the flock — first to the feeder, first to the hand, full of feather-puffing and war-cries when another bird got too close. In time he grew brave enough to take a seed delicately from between my lips. The feathers on his head grew back, but he was marked forever with one tiny patch of white in his black cap. Being able to recognize an individual bird piqued our curiosity; we began to wonder about who is paired to whom, and how long does it last, and what about children? I mean, for all we knew we might have something more exciting than the afternoon Soaps, if we could just tell one bird from another. And just how many chickadees do we have? (There seem to be dozens, to judge by the rate at which they come and go.)

Having spent several summers assisting Stuart Houston in his raptor-banding research, I have a banding license, and applied for a special permit to put coloured bands on our local chickadees. Two afternoons was all it took to trap each of the birds in our flock in a wire cage trap atop the feeding platform, fitting each chickadee with a numbered aluminum band and two of coloured plastic. The trapping and banding didn't seem to traumatize them: they were back at the feeder within minutes of being released. First caught, and rewarded with two white bands, was — of course — Ratbag. Rechristened White/White, he remained Top Bird until the spring of his fifth year (a Methuselah among chickadees!), when Red/Red, the toughest fledgling of the previous year, began to muscle in at the feeder. Ratbag disappeared in the Fall. Red/Red vanished early this summer. It's been nice to know our birds as individuals, but a little sad, too.

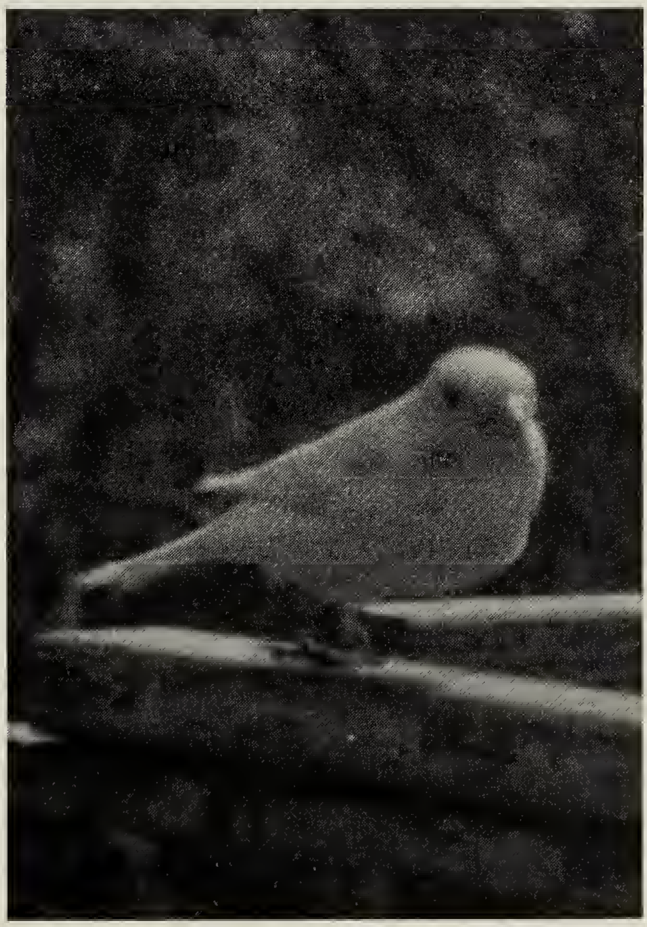
So what have we learned in three years of banding? Well, our initial guess of "dozens" of birds was exaggerated. We had precisely 11 chickadees that first autumn, and though we banded 18 birds over the next two years it appears that the population using our feeder generally hovers around 12, with half the new fledglings moving off to new territory in the late fall, and one or two unbanded birds joining ours during the winter. Do mated pairs stay together more than one season? In one case, yes; in three cases, no.

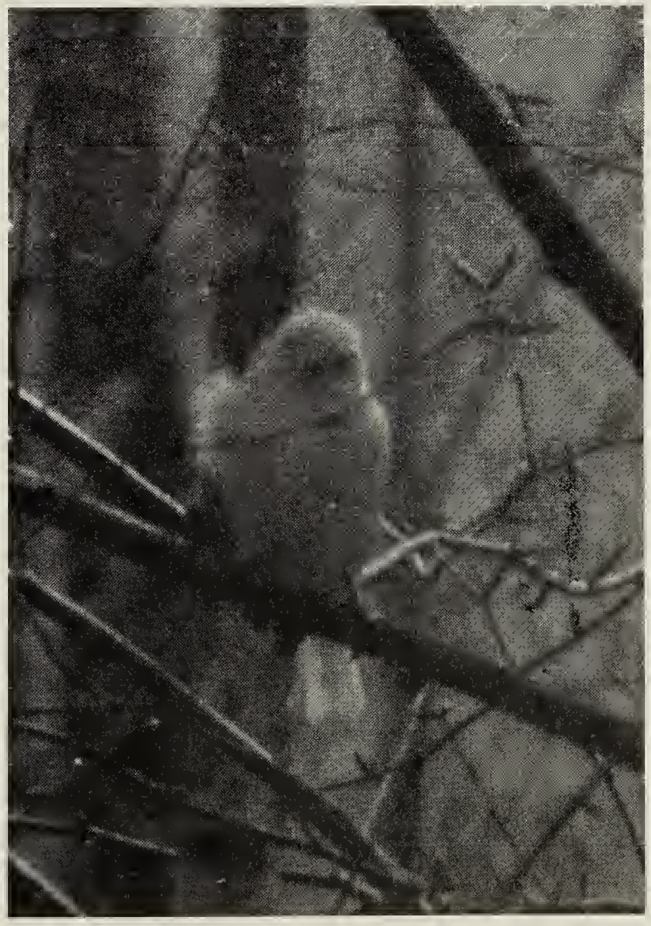
The flock stays together through the winter, but when mating season arrives they disperse. The dominant bird and his/her mate (how do you determine the sex of a chickadee?) remain "in possession" of the feeder, though sometimes a second pair will feed when the owners are out of sight. In the fall everybody blends back into one flock, with the newly banded youngsters waiting their turn for the adults at the feeder. The pushiest youngster, however, seems destined to be Number One Chickadee in a year or two. About half the young birds have vanished from our feeder by the end of their first winter, some to set up on new territory, but doubtless some succumb to bad weather, poor food supplies, and predators. The remaining birds generally seem to survive for two to three years. One year we thought we'd lost all "our" birds, but later discovered that a neighbour had accidentally spilled a huge bag of sunflower seeds on the ground by his barn. When they had grazed out the pastures of plenty, the flock of fat little chickadees returned to our more modest feeding station. Last December, however, when we had a sudden and very nasty two weeks of bitter weather, only four of our regular 10 birds continued to appear at the feeder. Did the others perish? We don't know; little birds are rarely noticed when they die, so very few recovered bands are returned to the Banding Office in Washington. The farthest afield that our banded birds have been sighted — and reported to us — is about a mile. But there's more to learn, so keep your eyes open: if you see a banded chickadee at your feeder note the colours, and which leg they're on. Stuart Houston has banded a number of chickadees in his Saskatoon neighbourhood, but there's no duplication in colours between his birds and ours. [Call us if you see a banded bird — 374-9176. We'll find out where "our" chickadees are going, and you'll learn a bit about where "yours" have come from.]

MYSTERY BIRD

Let me have your suggestions on the identity of this albino bird. You are welcome to phone me at 652-5268, or e-mail at minke@link.ca, or by mail c/o Nature Saskatchewan. The results (consensus?) will be published in a future issue.

By direct comparison to the Evening Grosbeak and Dark-eyed Junco, the bird is estimated to be around 7 1/4" long. On other photos it shows a flattish head with the eye closer to the base of the bill than the rear of the head. It has a broad-based conical bill. The tail is squarish at the end, with a slight notch. It was seen at Beth Dale's feeder on Murphy Lake, near Loon Lake, SK.





COPULATORY BEHAVIOUR IN GREAT HORNED OWL

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Introduction and Background

This paper is based on daily observations of a single pair of Great Horned Owls (*Bubo virginianus*) conducted at Fish Creek Provincial Park, Calgary, Alberta from 3 February 1992 until 27 February 1992. Roughly thirty hours of observations were made during this period. Twelve copulations were observed between 8 February and 23 February.

Most of the observations occurred in a roughly circular area 300 metres in diameter, bounded on the northwest by a housing subdivision, and on the southeast by the Bow River. Due to mild winter conditions this section of the river remained open and supported a population of waterfowl. Observations were at least one hour in duration with one observer assigned to each owl. The study concentrated on an observation period beginning before sunset and continuing until well after dark.

Methodology

We conducted our observations in the following manner. We each carried a spotting scope and tripod, binoculars, small tape recorder, synchronized watch, and hand-held CB radio. We also carried an incident light meter. The owl's territory was fairly open ground with stands of trees along the river. We began our observations during the last part of daylight when the owls were easy to spot. We became experts at spotting the owls huddled next to tree trunks in one of a dozen favourite perches at distances of up to 500 metres. We would then slowly work our way in as close as we dared and position ourselves to get the best view of the action. We quickly learned what distance to stay at so that we were not disturbing the birds. Not knowing in which direction the owls would necessarily fly, we would position ourselves as far apart as possible while keeping both owls under constant observation. Coordinating our observations by radio, we could keep track of who was observing which owl, and as the owls moved we would sometimes switch which one we were watching to avoid unnecessary movement.

As night fell, we could continue to see the owls in full detail right down until we could not read the incident light meter any more but by then the "action" was over, and "Fred" had departed on his nightly hunting rounds. Even at that late hour we could usually silhouette the owls against the night's sky, or on cloudy days, against the clouds illuminated by the glow of the city lights.

Once we had placed ourselves in good positions from which to observe, we would set up our spotting scopes and go to work. We set our quartz watches to the time signal from WWV/WWVH so that our time hacks would be identical, and also we would be within 1/10 second of UTC so that we could compare our data to meteorological or astronomical events recorded by Environment Canada. We would start our tape recorders, state the date and time, which owl we were observing, etc., and then we would begin to observe the owl and record every movement that the owl made. Every five minutes or so we would do another time hack. We just let the tapes run in real time while we recorded every motion made by the owls. Along with my time hacks we would add the incident light level as recorded on the light meter. I have not had the light meter calibrated (I'm not sure who could do this) so I don't know what the measurements correspond to, other than to say they would be some fraction of foot-candles.

Once the observation was complete (usually after the male flew away to hunt and was lost from sight in the darkness) we would play back the tape and transcribe the observation. We used a stopwatch and the recorded time hacks to assign a time to each observed event. This ethological method was used for every observation. We have 37 approximately one-hour tapes of which 20 have been transcribed. Those not transcribed are either duplicate records for the same owl, or for the latter part of the study (22-27 February) when copulatory behaviour had ceased. (The transcripts (and tapes) can be made available to anyone who might be interested.)

At one point we borrowed a microphone from Ross Lein at the University of Calgary in order to try to capture one of these mating events. Since his microphone was very cumbersome I bought my own, a Sennheiser ME-80 directional mike, which was more compact, and had even better acoustics. We noticed that about 50% of the matings occurred in the same tree, so we lay on the snow under the tree under a piece of camouflage netting with the microphone and a video camera. I managed to catch one copulation on video, but the conditions were too hard on the camera (the battery would cease operating and I could not move to change packs) so we gave up on the video. However, I recorded a couple of excellent calls during the copulation from a distance of about 20 metres.

For control purposes we also made an observation in the early morning, before sunrise, and an observation during the middle of the day.

Copulatory Behaviour

Copulatory behaviour was observed to follow this general pattern:

As the evening approaches, the male begins a period of increased hooting activity characterized by contact calls. Contact calling in both sexes occurs from an upright, forward-leaning posture. The head faces forward in line with the body, the back is straight, and the tail is down, or bobs up slightly with each call note. The owl appears to be incapable of calling with the head turned. The throat visibly inflates just prior to hooting, and the white patch at the base of the throat of the male becomes much more visible. Between calls the throat patch decreases in size back to normal size.

These contact calls are usually initiated by the male, with the female responding within two to four seconds after the male's call has ended. On average the female responds to every second call. During this contact calling phase, the male calls at an average rate of 0.8 ± 0.6 calls per minute. The female calls at a rate of 0.4 ± 0.5 calls per minute. These rates can be contrasted with those observed during the day, when the call rate was observed to be one call per hour (0.02 calls per minute) for both sexes.

In all observations, the male engages in preening during this contact call period. Characteristic behaviours are "toe picking," where the beak is used to pry at the talons; "cheek scratching," where the feathers on either side of the face are scratched with a foot (this is always same side scratching); and "nuzzling and pulling up," where the face is rubbed into the wing or tail feathers, a single feather is picked up in the beak, and the whole length of the feather run through the beak. Wing stretching and beak snapping are also common. The male usually exhibits all of these preening behaviours. The female does little or no preening at this time.

After the male completes preening, a period of courtship calling begins. This is characterized by both owls adopting the "booming" posture. The head is held straight in line with the body, the body leans forward to the horizontal and the back is arched. The middle of the back is lower than the head and rump, and the tail is raised vertically during the entire call. The throat patch is inflated throughout the call, and remains fully, or partially, inflated between calls. The transition from contact calling to courtship calling (booming posture) is usually a gradual process with the owl assuming a more and more horizontal posture for successive calls. During courtship calling, the owls may edge out along the branch that each is roosting on, away from the trunk. This action seems to be meant to give the owl an unobstructed exit from the perch.

The male then often flies from his roosting perch to the tree in which the female is roosting (six of nine observations). He always selects a perch higher than the female's. Calling in the booming posture will then become very intense, with the female usually calling in response to every call made by the male. She will also enter a period of responding on the first note of the male's call. Eventually the lead role in calling becomes unclear. The female may begin to initiate calls to which the male may or may not respond. The lead may sway back and forth during this phase. The male's call rate increases to an average of 2.7 ± 1.1 calls per minute, and the female's increases to 2.3 ± 1.2 calls per minute.

In eight out of nine observations, the female flies from her roosting perch and lands in a nearby tree just prior to copulation. She always selects a "hunting" perch, characterized by being far from the trunk, high in the tree, and surrounded by an unobstructed field of view and no obstacles to flight. Within a minute or so the male leaves his perch and flies directly to the back of the female.

Call rate does not appear to be a trigger for copulation. In the four cases where the male flew to the female's roosting tree and then the female subsequently left to fly to a hunting perch for copulation, the male's call rate decreased to 1.2 ± 1.2 calls per minute, while the female's decreased to 1.5 ± 0.7 calls per minute between the time that the female left and the copulation occurred. In addition, copulation was observed when call rates did not increase, and high call rates were not always followed by copulation. The total number of calls preceding copulation varies from 13 to 196, and so also does not appear to be a factor in triggering copulation. Overall, the male hoots 1.5 times more frequently than the female prior to copulation.

During copulation the female's posture is horizontal, and her wings are folded and seem to be held slightly away from her body. Her tail is raised, and her back is arched downwards. Her head is raised with the beak open. Copulation is brief, lasting four to seven seconds.

The male's wings are outstretched and flapping (roughly four beats per second) presumably to keep balance. His back is arched downwards, his tail is up and his head is down. He nuzzles at the feathers of the female's nape with his beak, and will also pull at these feathers (similar to the "nuzzle and pull up" preening behaviour). Treading is apparent. Both owls engage in a unique series of copulatory vocalizations comprised mainly of short, rapid notes and a high-pitched squeal. (These vocalizations are described later.)

Once copulation is complete the male flies directly from the back of the female to a hunting perch in a different tree, whereupon calling drops to only one or two widely spaced contact hoots. This reduction in call rate occurs when the male leaves the area, regardless of whether copulation has occurred. The only time a second copulation was observed, it took place over an hour later.

After copulation, the female remains motionless on the perch where copulation occurred. She remains nearly horizontal, and the base of her tail shows spasmodic muscular movements for up to ten minutes afterwards. The reason for these movements is unclear; perhaps they assist fertilization. At the end of this post-copulatory phase, the female assumes a more upright posture, and generally fluffs up her feathers which were flattened during flight or copulation. She usually engages in a period of preening involving all the behaviours noted earlier. She leaves this perch only to return to the tree where she was roosting. Unlike the male, she was never observed to leave the immediate area.

Although some authors have described ritual bowing, mutual preening, and mate feeding prior to copulation, none of these behaviours was observed. Although food caching was observed on two occasions, the male was never seen to bring food to the female. These rituals may apply only during initial pair bonding, which we did not observe.

Vocalizations

The male's call notes are lower in pitch than the female's. The male's normal call consists of a four note sequence "Hoo hoo — hoo hoo." "I'm here — are you?" The female's normal call is higher in pitch than the male's, and contains an extra note at the beginning "hoo hoo hoo — hoo hoo." "I'm still here — you too?" During the entire observational period, no variance in this normal call structure was observed.

As the male flies to the back of the female for copulation, both owls begin a series of short, rapid hoots (four or five per second). These hoots are continued throughout the entire copulation. Shortly after the male lands, a warbling, high-pitched squealing call (reportedly similar to the fright call made by owlets) is made by one of the owls. In one recording this squealing call began 1.9 seconds after the beginning of the short hoots and lasted for 1.6 seconds. The short hoots ended 0.8 seconds later. The total duration of these calls (and this copulation) was 4.3 seconds. This call structure was typical of all copulations. In some copulations, immediately following the squeal there was a variable length chatter reminiscent of a kingfisher or squirrel. A normal call from both owls signals the end of copulation.

Correlation to Incident Light Level

On five days during which copulations were observed, measurements of incident light were also taken using a hand-held light meter. All first copulations occurred when light levels were between seven units and three units. It took from six to nine minutes for light levels to fall through this range (sample size n=5), yet these "windows" were separated by as much as ten minutes by absolute time of day.

The table below lists copulation times in absolute time (MST), incident light measurement at the time of copulation, time of copulation relative to sunset, and weather conditions.

At the time at which the observations were conducted, light levels changed by 1.7 units within 00:01:24 ± 00:00:57.

Summary

Copulation in Great Horned Owls *(Bubo virginianus)* is brief, lasting four to seven seconds. Copulation was observed to occur exclusively in trees on high, unobstructed perches. Pre-copulatory rituals such as bowing, mutual preening, and mate feeding were not observed. These rituals might only occur during initial pair bonding.

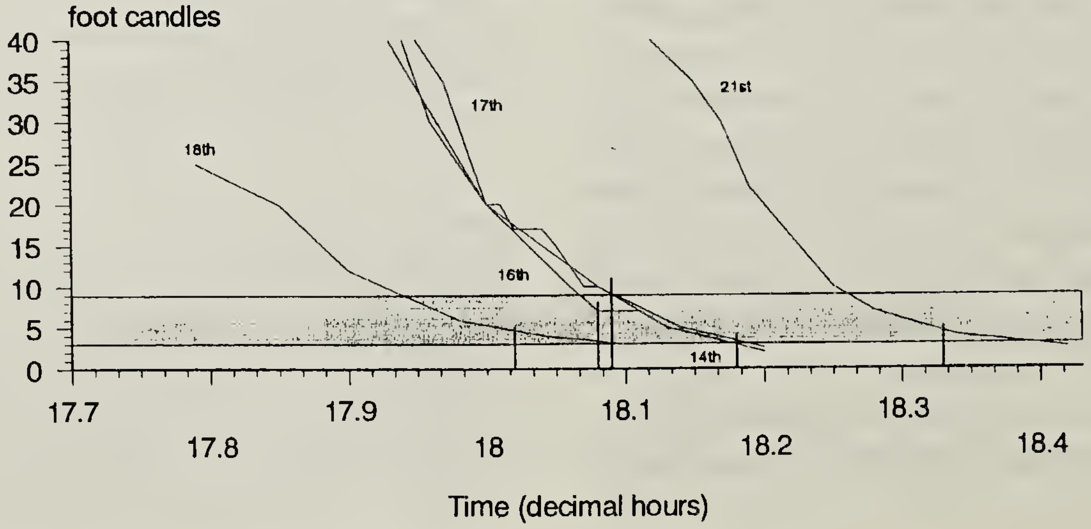
Copulation is accompanied by three unique vocalizations: a series of short, rapid hoots, a high-pitched squeal, and occasionally a trailing variable-length chatter. Call frequency does not appear to correlate with copulation. We suspect that the purpose of the observed increases in calling may be to improve pair bonding, establish territory, or to encourage the female to move to a more accessible perch for copulation. The total number of calls preceding copulation also does not appear to be a controlling factor.

Incident light correlates with copulation better than time does. In the field we found that we could predict the level of activity more reliably using a light meter than by using a watch. Additional study in this area is warranted.

Acknowledgements: C. Stuart Houston provided constructive criticism.

Incident Light & Copulation Time

Feb. 14 - 21, 1992



THE BAIRD'S SPARROW: STATUS RESOLVED

STEPHEN K. DAVIS, DAVID C. DUNCAN AND MARGARET A. SKEEL,
Saskatchewan Wetland Conservation Corporation, Room 220, 2050 Cornwall Street, Regina, SK. S4P 2K5

The loss and degradation of native prairie habitat has likely caused grassland birds to decline more than any other bird guild in North America.[14] Subsequently, many grassland bird species have been identified as species of concern in Canada and the United States. One such species, the Baird's Sparrow, was listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as a threatened species in 1989.[12] It was assumed that the Baird's Sparrow had "suffered declines proportional to the demise of North America's native grassland" since settlement[9] was based on information that indicated that the Baird's Sparrow was a native prairie specialist.[2,18,29] Subsequent to its listing as a threatened species, a recovery plan was prepared for the Baird's Sparrow with the disclaimer that the species' status was "currently in question" and that "additional information on numbers and distribution may be sufficient to resolve its status."[12] The Saskatchewan Wetland Conservation Corporation responded to this need by initiating studies to determine the distribution, abundance, and habitat preferences of Baird's Sparrows in southern Saskatchewan, the heart of the species' breeding range. These studies indicated that the species' population in Saskatchewan was much greater than previously thought and that Baird's Sparrows were not restricted to native prairie habitat (see below). Subsequently the Baird's Sparrow was de-listed in the spring of 1996.

In 1994 we conducted grassland songbird surveys which covered most of the agricultural zone of Saskatchewan (Fig. 1). Observers recorded birds on 1739 point counts along 93 routes. Seventy-six routes were chosen by randomly selecting township air-photo mosaics with each random route comprised of approximately 80% grassland habitat. Because we were dealing with a threatened, and presumably uncommon species, an additional 17 routes were chosen based on information from Saskatchewan birders and biologists as to where high Baird's Sparrow densities might be located. Road- and trail-side surveys were patterned after Breeding Bird Surveys (BBS) with stops spaced 0.8 km (0.5 mi) apart, but with listening periods of 5 min. rather than 3 min.

Distribution

Baird's Sparrows were recorded in virtually all parts of the Mixed and Moist-mixed Grassland ecoregions and were detected in 5 of 11 routes in the Aspen Parkland ecoregion (Fig. 1). The highest densities of Baird's Sparrows occurred along the border of the Mixed and Moist-mixed Grassland ecoregions in the Missouri Coteau, similar to the distribution found in North Dakota.[25]

Relative Abundance

Baird's Sparrows were the fifth most abundant songbird we recorded on random native grassland routes in our 1994 survey (Table 1).

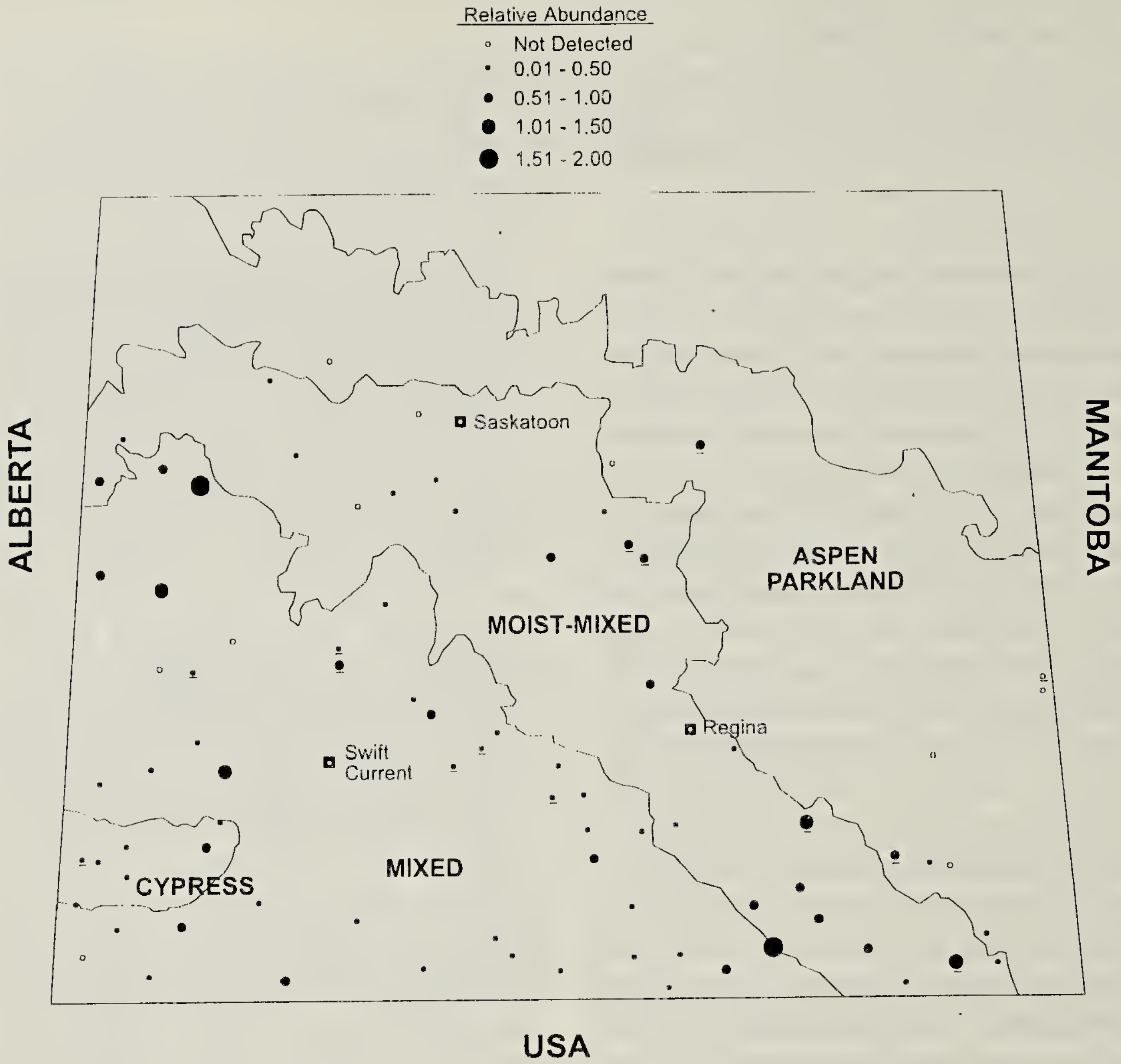


Figure 1. Distribution and relative abundance (x no. of singing males/route) of Baird's Sparrow in native prairie in the Aspen Parkland, Mixed and Moist-mixed Grassland and Cypress Upland ecoregions of southern Saskatchewan.

Table 1. NUMBER OF SINGING MALES DETECTED AND FREQUENCY OF OCCURRENCE OF SEVEN OF THE MOST ABUNDANT GRASSLAND SONGBIRD SPECIES RECORDED ON RANDOM, NATIVE GRASSLAND ROUTES IN SOUTHERN SASKATCHEWAN, 1994 (adapted from Skeel et al.[23])

Species	Number of Singing Males Detected (n=1911)[1]	Frequency of Occurrence (%)[2]
Western Meadowlark	1853	61
Horned Lark	1156	41
Clay-colored Sparrow	1134	40
Vesper Sparrow	1018	39
Baird's Sparrow	1014	34
Sprague's Pipit	768	34
Chestnut-collared Longspur	842	23

[1] Singing males recorded inside 100-m radius circles in a five-minute period.
[2] Proportion of circles in which the species was detected.

Table 2. MEAN NUMBER (±SE) OF SINGING MALES DETECTED AND THE FREQUENCY OF OCCURRENCE OF SEVEN OF THE MOST ABUNDANT GRASSLAND SONGBIRD SPECIES RECORDED ON NATIVE AND CRESTED WHEATGRASS PASTURES IN SOUTHERN SASKATCHEWAN, 1995 (adapted from Davis and Duncan[6])

	Crested Wheatgrass (n=203)[1]		Native (n=192)		Total (n=395)	
Species	Males Detected[2]	Frequency of Occurrence (%)[3]	Males Detected	Frequency of Occurrence (%)	Males Detected	Frequency of Occurrence (%)
Baird's Sparrow	0.88±0.05	65	0.66±0.05	53	0.77±0.04	59
Chestnut-collared Longspur	0.59±0.06	40	0.90±0.07	60	0.74±0.05	50
Horned Lark	0.63±0.05	46	0.60±0.05	45	0.62±0.04	46
Brown-headed Cowbird	0.38±0.06	26	0.55±0.06	36	0.47±0.05	31
Clay-colored Sparrow	0.13±0.03	10	0.54±0.05	42	0.33±0.03	26
Western Meadowlark	0.29±0.04	25	0.21±0.03	20	0.25±0.02	23
Sprague's Pipit	0.15±0.03	13	0.33±0.04	32	0.24±0.02	23

[1] Number of 100-m radius circles
[2] Singing males recorded inside 100-m radius circles
[3] Proportion of circles in which the species was detected.

A separate study conducted in 1995 using off-road 100-m point counts (n=395) in the Missouri Coteau found that Baird's Sparrows were the first and second most common species recorded on Crested Wheatgrass (*Agropyron cristatum*) and native pastures, respectively (Table 2). Comparisons between species, however, may be confounded by different detectabilities among species (Grasshopper Sparrows are more difficult to hear than Western Meadowlarks, for example, and thus may be detected less often) and the influence of a roadside bias (unpublished data collected by the author shows that Vesper Sparrows are attracted to roadside habitat, for example, whereas Baird's Sparrows avoid this habitat). Despite the inherent problems in comparing species, our counts clearly show that Baird's Sparrows are one of the more common grassland birds in Saskatchewan, particularly along the border of the Mixed and Moist-mixed Grassland ecoregions.

Population Size

We conservatively estimated that the 1994 population of Baird's Sparrows in Saskatchewan was 960,000 singing males.[23] Estimates of the population in North Dakota range from 376,000 singing males in 1967,[26] to 171,000 in 1992 and 279,000 singing males in 1993.[30] Because these estimates include only singing males, the actual population sizes would be double if a 50:50 sex ratio in the populations is assumed. Although Baird's Sparrows can be erratic in occurrence from year to year in a given area, these provincial and state population estimates indicate that this species is abundant and not on the brink of extinction, especially considering that these estimates do not include populations from Montana, Alberta, Manitoba and South Dakota.

Population Trend

Although there is little direct evidence, Baird's Sparrows and many other grassland birds have undoubtedly declined in the past century due to intensive agriculture and the subsequent loss of grassland habitat. Davis et al.,[7] for example, found that seven of eight grassland songbirds, including Baird's Sparrow, occurred less frequently in cropland compared to native grassland. In Manitoba, the Baird's Sparrow was

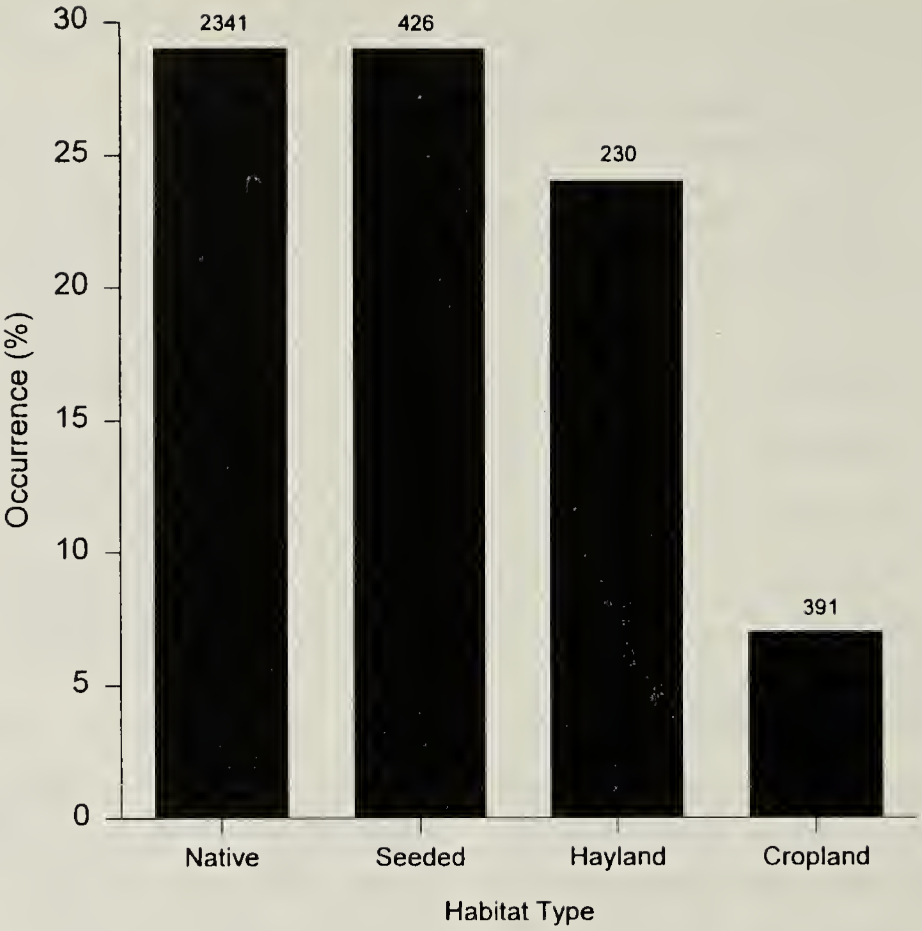


Figure 2. Percent frequency of occurrence of singing males detected in native grassland, seeded pasture, cropland, and hayland in southern Saskatchewan (adapted from Davis et al.[7]). Number of sampling points given above each bar.

once considered to be one of the most common birds on the prairies,[28] but its range is now restricted to the extreme southwest portion of the province. On a continental scale, BBS trend data from 1966 to 1995 for North America show no significant population trend, although a slight decline of 1.2% per year is indicated. This suggests either a stable or slowly declining population. Numerous other grassland songbirds such as Sprague's Pipit, Grasshopper Sparrow and Horned Lark show much larger and significant population declines.[21] Trend analysis for the Baird's Sparrow, however, could be confounded by the species' erratic occurrence in different parts of its range.[12]

Habitat Use

In our 1994 study, we surveyed seeded pasture, hayland and cropland in addition to native prairie. The results showed that Baird's Sparrows occurred with equal frequency in native grassland, seeded pasture and hayland, and less often in cropland [7] (Fig. 2). In addition, our 1995 comparison of grassland songbird occurrence in Crested Wheatgrass and native pastures clearly showed that Baird's Sparrows are not native prairie specialists.[6] In fact, Baird's Sparrows were recorded more frequently in Crested Wheatgrass (65%) than they were in native (53%) pastures (Table 2). Numerous other studies have documented Baird's Sparrows using a variety of non-native habitat types such as seeded pasture, seeded hayland and cropland.[1,2,5,10,11,15,19,20,22,23,25,27] These results suggest that Baird's Sparrows respond to vegetation structure rather than vegetative species composition, permitting them to inhabit non-native habitat which structurally resembles native prairie (see also [16]).

Baird's Sparrows appear to be influenced by grazing intensity, which alters vegetation structure.[3,13] Although some studies have found that grazed grasslands supported fewer Baird's Sparrows than idle areas,[4,17,18] these localized studies were based on small sample sizes and were not designed to examine various levels of grazing intensity as in our study.[7] In addition the response of Baird's Sparrows to grazing pressure appears to vary geographically.[13,24] In dryer parts of their range, for example, Baird's Sparrows will not inhabit areas that are not managed through grazing or prescribed burning.[16]

Although Baird's Sparrows are present in habitats other than native prairie, their breeding status and productivity in non-native habitats has been questioned. There are, however, clear indications that they do breed in seeded grassland. Davis (unpubl. data) found that 23% of 75 Baird's Sparrow nests were associated with smooth Brome Grass (*Bromus inermis*) in southwestern Manitoba and that 27% of 51 Baird's Sparrow nests in the Prairie Nest Record Scheme for which native or seeded habitats could be discerned, were located in non-native habitats. In addition, Davis[5] and Davis and Sealy[8] found that Baird's Sparrows were productive in non-native habitats, although direct comparisons of productivity in seeded and native pastures were not conducted.

Summary

The Baird's Sparrow is widely distributed across the grassland ecoregions of Saskatchewan. It commonly occurs in native and non-native habitats and has been recorded breeding in grasslands invaded with Brome Grass and Crested Wheatgrass as well as Alfalfa hayfields. Estimates of their population size indicate that they are in no immediate danger of extirpation/extinction although their relatively small breeding and wintering ranges suggest that the global population size is smaller than more widely distributed grassland species. Our results, combined with an examination of available literature, indicate that the de-listing of Baird's Sparrow was justified as the available information was "sufficient enough to resolve its status"[12] after all.

Acknowledgements

The 1994 and 1995 studies would not have been possible without funding support from the National Fish and Wildlife Foundation (USA), Endangered Species Recovery Fund (World Wildlife Fund Canada and Canadian Wildlife Service of Environment Canada), and Saskatchewan Endangered Species Fund (Saskatchewan Environment and Resource Management). We are grateful to our dedicated surveyors: L. Banman, C. Bjorklund, P. Hjertaas, R. Kreba, J. Pollock, R. Shaw, and T. Troupe. Thanks to T. Riche (Prairie Farm Rehabilitation Administration), J. Keith (Saskatchewan Conservation Data Centre) and D. Anstey for their assistance in the production of distribution maps. Thanks also to D. Prescott and G. Sutter for providing useful comments on the manuscript.

1. BELCHER, M. 1980. Birds of Regina. Sask. Nat. Hist. Soc. Spec. Publ. No. 12. 151 pp.
2. CARTWRIGHT, B.W., T.M. SHORTT and R.D. HARRIS. 1937. Baird's Sparrow. *Trans. Royal Can. Institute.* 46:21(2):153-198.
3. DALE, B.C. 1983. Habitat relationships of seven species of passerine birds at Last Mountain Lake, Saskatchewan. M.Sc. Thesis. University of Regina, Regina, SK. 119 pp.

4. ——. 1984. Birds of grazed and ungrazed grasslands in Saskatchewan. *Blue Jay* 42:102-105.

5. DAVIS, S.K. 1994. Cowbird parasitism, predation, and host selection in fragmented grassland of southwestern Manitoba. M.Sc. Thesis. University of Manitoba, Winnipeg, MB. 77 pp.

6. DAVIS, S.K. and D.C. DUNCAN. 1996. Grassland songbird abundance in native and crested wheatgrass pastures of southern Saskatchewan. Unpublished report, Saskatchewan Wetland Conservation Corporation, Regina, SK. 18 pp.

7. DAVIS, S.K., D.C. DUNCAN, D.A. ANSTEY and M.A. SKEEL. 1996. Habitat selection of grassland songbirds in southern Saskatchewan. Unpublished report, Saskatchewan Wetland Conservation Corporation, Regina, SK. 26 pp.

8. DAVIS, S.K. and S.G. SEALY. In press. Cowbird parasitism and nest predation in fragmented grasslands of southwestern Manitoba. *In*: The ecology and management of Brown-headed Cowbirds in North America.

9. DE SMET, K.D. and W.S. MILLER. 1989. Report on the status of the Baird's Sparrow, *Ammodramus bairdii*, in Canada. Unpublished report prepared for the Committee on the Status of Endangered Wildlife in Canada. 28 pp.

10. DE SMET, K.D. and M.P. CONRAD. 1991. Management and research needs for Baird's Sparrows and other grassland species in Manitoba. Pp. 83-86 *in*: Holroyd, G.L., G. Burns and H.C. Smith (eds.). Proceedings of the second endangered species and prairie conservation workshop. Provincial Museum of Alberta Natural History Occasional Paper No. 15. 284 pp.

11. GODFREY, W.E. 1950. Birds of the Cypress Hills and Flotten Lake regions, Saskatchewan. Natl. Mus. Can. Bull. No. 120. 96 pp.

12. GOOSSEN, J.P., S. BRECHTEL, K.D. DESMET, D. HJERTAAS and C. WERSHLER. 1993. Canadian Baird's Sparrow recovery plan. Recovery of Nationally Endangered Wildlife. Rep. No. 3. Ottawa. Canadian Wildlife Federation. 28 pp.

13. KANTRUD, H.A. and R.L. KOLOGISKI. 1982. Effects of soils and grazing on breeding birds of uncultivated upland grasslands of the northern great plains. USFWS Wildlife Report #15. Washington, D.C. 33 pp.

14. KNOPF, F.L. 1994. Avian assemblages on altered grasslands. *Stud. Avian Biol.* 15:247-257.

15. LANE, J. 1968. *Ammodramus bairdii* (Audubon): Baird's Sparrow. Life histories of North American cardinals, grosbeaks, buntings, towhees, finches, sparrows and allies. *U.S. Natl. Mus. Bull.* 237:745-765.

16. MADDEN, E.M. 1996. Passerine communities and bird-habitat relationships on prescribed-burned, mixed-grass prairie in North Dakota. M.Sc. Thesis. Montana State University-Bozeman, Bozeman MT. 153 pp.

17. MAHER, W.J. 1973. Birds: I. Population dynamics. Matador project technical report No.34. Canadian Committee for the International Biological Programme, Saskatoon, SK. 56 pp.

18. OWENS, R.A. and M.T. MYERS. 1973. Effects of agriculture on populations of native passerine birds of an Alberta fescue grassland. *Can. J. Zool.* 51:697-713.

19. RENAUD, W.E. and D.H. RENAUD. 1975. Birds of the Rosetown-Biggar district, Saskatchewan. Sask. Nat. Hist. Soc. Spec. Publ. No. 9. 121 pp.

20. RENKEN, R.B. and J.J. DINSMORE. 1987. Nongame bird communities on managed grasslands in North Dakota. *Can. Field-Nat.* 101: 551-557.

21. SAUER, J.R., S. SCHWARTZ, B.G. PETERJOHN and J.E. HINES. 1996. The North American Breeding Bird Survey Home Page. Version 95.1. Patuxent Wildlife Research Center, Laurel, MD.

22. SCHMIDT, L. 1990. The Baird's Sparrow in southwestern Alberta. *Alberta Naturalist* 20:129-130.

23. SKEEL, M.A., D.C. DUNCAN and S.K. DAVIS. 1995. Abundance and distribution of Baird's Sparrows in Saskatchewan in 1994. Revised report — October 1995. Unpublished report, Saskatchewan Wetland Conservation Corporation, Regina SK. 17 pp.

24. SOUSA, P.J. and W.N. MCDONAL. 1983. Habitat suitability models: Baird's Sparrow. U.S. Dept. Int., Fish Wildl. Serv. FWS/OBS-82/10.44. 12 pp.

25. STEWART, R.E. 1975. Breeding birds of North Dakota. Tri-college Center for Environmental Studies, Fargo, ND. 295 pp.

26. STEWART, R.E. and H.A. KANTRUD. 1972. Population estimates of breeding birds in North Dakota. *Auk* 89:766-788.

27. SUTTER, G.C., T. TROUPE and M. FORBES. 1995. Abundance of Baird's Sparrows, *Ammodramus bairdii*, in native prairie and introduced vegetation. *Ecoscience* 2:344-348.

28. THOMPSON, E.E. 1891. The birds of Manitoba. Proceedings of the United States National Museum. 13:457-643. Second edition reprinted (1975) by Premium Ventures, Winnipeg, MB.

29. WERSHLER, C. 1990. Status of the Baird's Sparrow in Alberta. Unpublished draft prepared for World Wildlife Fund Canada, Endangered Species Recovery Fund and Alberta Fish and Wildlife.

30. JOHNSON and IGLE *pers. comm.*

POETRY

A NURSERY RHYME

Sing a song of sixpence
A pocket full of rye
Four and twenty blackbirds baked in a pie,
When the pie was opened the birds began to sing
Wasn't that a dainty dish to set before the king?

Editor's note: This nursery rhyme from the Middle Ages is based on fact. It was popular amusement at major feasts to bake a pie shell and then seal a group of songbirds inside. In this case they used the abundant Eurasian Blackbird, a black-coloured equivalent of our Robin. When the pie was cut in front of the unsuspecting guests the birds would burst forth, to the startled amusement of all. The practice was short-lived, as the novelty soon wore off.

SOME PARASITIC FLOWERING PLANTS OF SASKATCHEWAN

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Parasites, in general, are organisms that live on or in other individuals and draw their nourishment from their hosts. Most plants, on the other hand, are autotrophic, and can manufacture their own complex nutrients independently from simple naturally occurring substances. But even here in the green (with chlorophyll), self-sustaining plant kingdom, evolution has perhaps been diverted several times to produce a small number of saprophytes and parasites. The saprophytes are those that survive on a wide variety of complex organic substances without depending on other plants. Their aerial parts are non-green (lacking chlorophyll) and the underground roots become variously modified by showing very irregular branching. Often these irregularly branched roots morphologically resemble corals, and hence they are called coralloid roots, as in some plants such as Pine Sap or Indian-pipe (*Monotropa*) of the family Monotropaceae, or Coralroot Orchid (*Corallorhiza*) of the family Orchidaceae. Their roots are usually associated externally and/or internally with fungi, and such an association is called mycorrhiza.

Unlike the saprophytes, parasites depend directly on other plants for their growth, development and reproduction. The parasites can be classified into two types — a) complete or holo-parasites and b) semi- or hemi-parasites. The complete parasites are those that depend on autotrophic plants for their living. They are non-green and can not photosynthesize. The semiparasites do contain chlorophyll but depend on other living plants for water and other simple nutrients. Some semiparasites in nature may or may not depend on hosts for their living. The former are called obligate semiparasites; the latter, facultative or circumstantial semiparasites. In all parasites, the roots, usually the lateral roots, become modified to form haustoria (the part of the fungus that penetrates the host), which help in the uptake of water and other nutrients. The facultative semiparasites, under favourable growth conditions, may not produce haustoria; they may remain as autotrophic plants.

Details of parasitism in some local species of Clustered Broom-rape (*Orobanche fasciculata*) and Bastard Toadflax (*Comandra umbellata*) have been investigated and are here described. In addition, other parasitic species which occur in Saskatchewan are also listed with a brief account of the nature of parasitism in each of them.

Orobanchaceae (Broom-rape family) — *Orobanche fasciculata* Nutt. (Clustered Broom-rape): Roots of this complete parasite are associated with roots of other host plants,

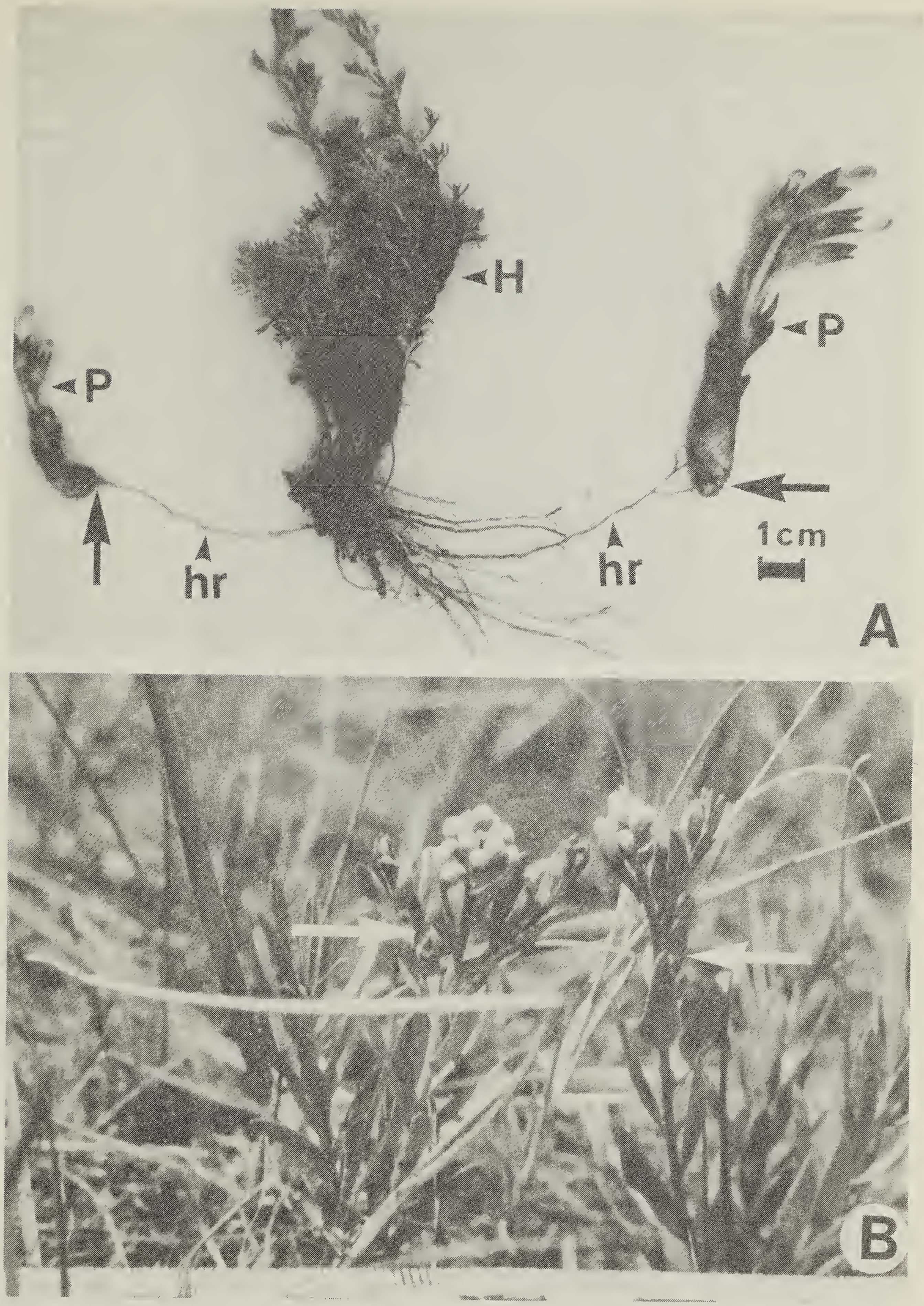

Figure 1. Pictures of Orobanche fasciculata *and* Comandra umbellata.

A. O. fasciculata *collected from field to show the basal attachment of the shoot to roots of* Artemisia frigida *(Prairie Sage). Arrows indicate the region of attachment. Note the flower buds in the parasite.*
B. C. umbellata *in the field to show the flowering shoots (white arrows). Centimetre ruler at the bottom. (H, host plant; hr, host root; P, parasite)*

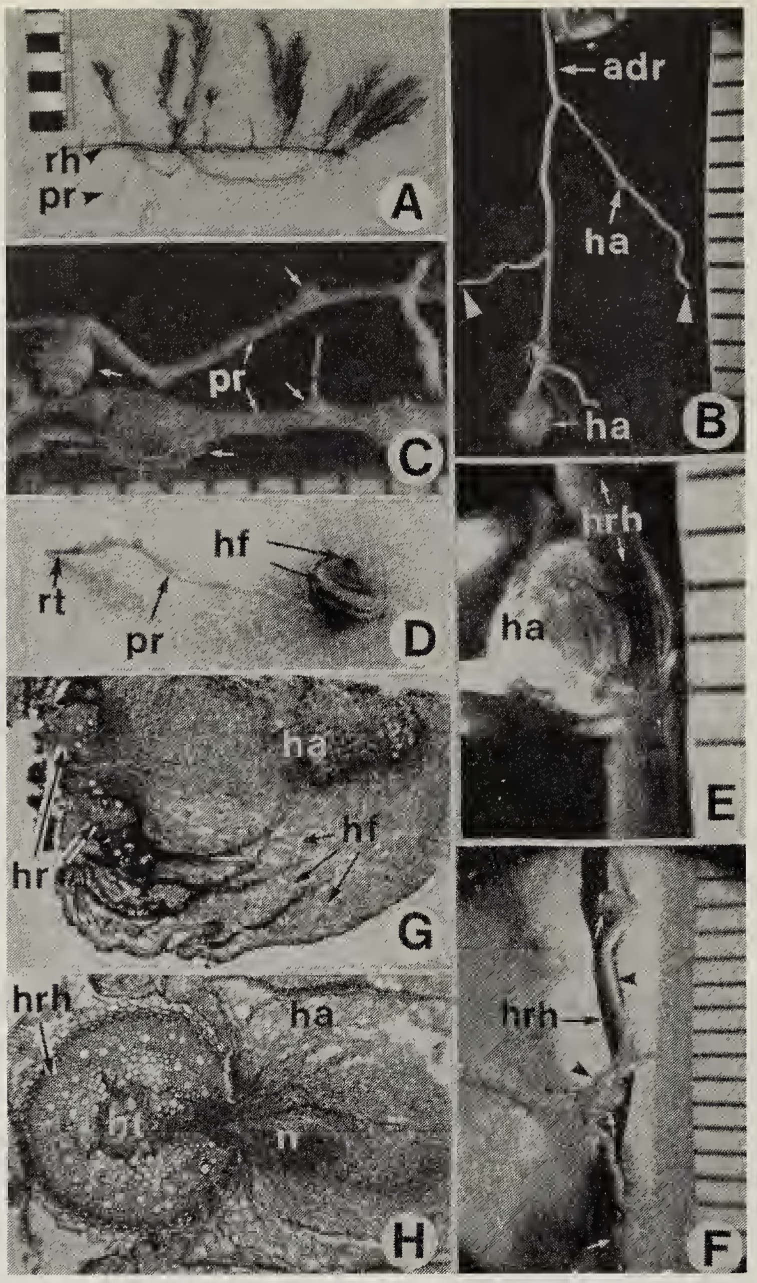

Figure 2. Pictures of Comandra umbellata *to show its habit, roots and haustoria.*

A. *A portion of the perennial plant to show the rhizome with many aerial shoots attached to it. Roots are adventitious developed from the rhizome. (centimetre ruler).*
B. *An adventitious root developed from rhizome showing three lateral roots. A lateral root almost at the tip is modified into haustorium. White arrow heads point at lateral root tips. (millimetre ruler).*
C. *Mature roots of the parasite to show haustoria (arrows). Roots indicate self-parasitism (haustoria attached to parasite roots). (millimetre ruler).*
D. *A root of the parasite showing the face view of a well developed haustorium, which shows characteristic haustorial (clasping) folds. Note the dead root tip. x 4.*
E. *Haustorium with its haustorial folds clasping the underground host rhizome of a grass (Northern Wheatgrass) (millimetre ruler).*
F. *Parasite root (black arrow heads) with its haustoria (white darts) attached to host (grass) rhizome. (millimetre ruler).*
G. *Long section of a haustorium showing haustorial or clasping folds in the periphery. The core (nucleus) or the central part of the haustorium has penetrated the host root to break it. x 90.*
H. *Long section of a haustorium showing the central core or nucleus has penetrated the rhizome of a grass (Northern Wheatgrass). Note the central tissue of the host rhizome is replaced by the haustorial tissue. x 90.*
(adr, adventitious root; ha, haustorium; hf, haustorial or clasping folds; hr, host root; hrh, host rhizome; n, nucleus or central core; pr, parasite root; rh, rhizome)

especially Pasture Sage (*Artemisia frigida*). The plant occurs in open prairies and ranches, close to aspen groves and seems to prefer dry sandy soils. An unbranched shoot emerging from shallow depths of soil terminates in an inflorescence of a few stalked flowers (Fig. 1A). The entire axis is covered by short bract-like leaves which are pinkish or purplish in colour indicating a lack of chlorophyll. Fruit capsules (fruits), on dehiscing (spontaneous opening), release numerous seeds. Seeds become buried in the ground and most of them remain dormant. Although some seeds germinate and produce seedlings, only a few, that are in contact with the roots of adjacent host plants, will survive.[4,13] In *O. fasciculata*, the primary root of a young seedling in contact with the host root becomes modified into a primary haustorium and remains attached to the host root (Fig. 1A). The central core of this haustorium establishes vascular connection with that of the host root.[4,13] The young seedling, thus attached to the host root, develops into a reproductive axis which emerges above ground to produce flowers (Fig. 1A). This species is an annual and does not develop an extensive root system of its own, nor does it develop secondary haustoria from lateral roots.

Louisiana Broom-rape (*Orobanche ludoviciana* Nutt.) and Small Broom-rape (*O. uniflora* L.) of the family Orobanchaceae are occasionally seen on the prairies. The habitat, habit and mode of parasitism of these species are similar to *O. fasciculata*.

Santalaceae (Sandalwood family) — (*Comandra umbellata* (L.) Nutt.) (Bastard Toadflax): This is a perennial root parasite occurring throughout the prairies, parkland areas and boreal forest of Saskatchewan. It survives predominantly by vegetative propagation, producing many new shoots from underground rhizomes (underground stems) to form small clones (Fig. 1B, 2A) and also to colonize new areas by the vigorous spread of rhizomes. It is a semiparasite with photosynthetic aerial shoots. Rhizomes produce new roots, called the adventitious roots (roots developed from stems); such roots (Fig. 2B, D-F) eventually develop lateral roots, some of which get modified into haustoria especially when they come in contact with the roots or rhizomes of adjacent plants (Fig. 2B-F). In this investigation, two species, *Artemisia frigida* (Pasture Sage) (Family Asteraceae) and *Agropyron dasystachyum* (Northern Wheatgrass) (Family Poaceae), have been identified as hosts. The haustoria have been collected at various stages of development and sectioned for microscopic study. Each haustorium develops from a young lateral root and on coming in contact with the host root produces a series of peripheral or haustorial or clasping folds, which help in the firm attachment of the haustorium to the host root or rhizome (Fig. 2D-G). Meanwhile, the central core, which is called the nucleus, can penetrate the host and mechanically destroy the host root (Fig. 2G) or rhizome (Fig. 2H) and absorb the nutrients available in them. In some instances, the haustoria of the parasite become attached to its own root, causing some destruction (Fig. 2C). This phenomenon is called self-parasitism, which is not uncommon in parasites, especially in semiparasites.

Several varieties of *Comandra umbellata*, including *livida*, *angustifolia*, and *pallida* have been recognized in Saskatchewan; they are very similar in their habit and parasitism to *C. umbellata*. See Kuijt[4] and Piehl[11] for more details on root parasitism.

The following are a few other parasites commonly found in Saskatchewan. Some of these plants appear normal (autotrophic) and it is rather difficult to recognize them as parasites unless their roots are carefully examined for haustoria under a microscope. Others, of course, can easily be recognized as complete parasites by their complete lack of green colour. Many published books on local floras, which deal with these species taxonomically, do not indicate that they are parasites. Because of this lack of information we have given some details relevant to the type of parasitism in the following species which form important components of the flora of Saskatchewan. We have also confirmed that the following species are indeed parasites by carefully examining herbarium specimens deposited in the George Ledingham Herbarium of the University of Regina, checking wild plants, and gathering information from published literature. Appropriate references have been provided in support of our observations of the following dicotyledonous species.

Loranthaceae (Mistletoe family) — *Arceuthobium americanum* Nutt. (American or Dwarf Mistletoe): This perennial species is a complete parasite, occurring as a stem epiphytic parasite most commonly on *Pinus banksiana* (Jack Pine). Its distribution includes the Cypress Hills and the boreal forests of northern Saskatchewan east to Ontario.

Arceuthobium pusillum Peck (Dwarf Mistletoe) (Family Loranthaceae): It is a perennial semiparasite, distributed commonly in the pine-spruce forests in northern Saskatchewan and in the Cypress Hills. This epiphytic stem parasite is commonly seen on *Picea mariana* (Black Spruce) in midwestern Saskatchewan. It is a smaller species and the habit and mode of parasitism are very similar to *A. americanum*. For more details see Kuijt [4] and Raju and Steeves.[12]

Convolvulaceae (Convolvulus family) — *Cuscuta gronovii* Willd. (Dodder): It is a complete stem parasite of the aerial parts of the host. This annual species occurs on different angiospermous (or flowering plant) hosts in the parklands and open moist woods in the prairies. It is also found in the Qu'Appelle Valley near Crooked Lake in southern Saskatchewan. The seeds germinate and produce small seedlings which very soon establish contact with the neighbouring autotrophic host plants. The primary root of the parasite soon dies and the stem parts of it wrap around the host stem. At the region of contact, the parasite stem produces small haustoria, which become attached to the host stem. Eventually, the central core or nucleus of each haustorium penetrates and establishes vascular connections with the internal tissues of the host stem. Such haustorial connections allow the parasite to have access to nutrients and water. For more details about haustorium in *Cuscuta*, see Kuijt.[4]

Scrophulariaceae (Figwort family) — *Castilleja miniata* Dougl. *ex* Hook. (Common Red Paint Brush): It is a semiparasite occurring commonly in the parklands, Cypress Hills and northern Saskatchewan. This perennial species is a root parasite, and its lateral roots become modified into haustoria, which are found attached to roots of a variety of flowering plants. It seems to depend on host roots for simple nutrients and water. The core or nucleus of the haustorium penetrates the host root, establishing vascular connection in it.

Castilleja coccinea (L.) Spreng. (Scarlet Paint Brush): It is a perennial semiparasite, commonly found in moist meadows and ditches in eastern Saskatchewan and in the parklands area. The habitat, habit and mode of parasitism are similar to those of *C. miniata*. For details of the haustroium in *Castilleja*, see Heckard,[3] Dobbins and Kuijt,[2] and Lytton et al.[6]

Melampyrum lineare Desr. (Cow-wheat): This semiparasitic annual species grows commonly in moist woodlands on sandy soils. It occurs along the Saskatchewan River banks and in pine-spruce woods in northern Saskatchewan. The roots of the parasite are usually attached to fine roots of grasses and other flowering plants. See Kuijt [4] and Lytton et al.[6] for more details.

Orthocarpus luteus Nutt. (Owl's-clover) (Family Scrophulariaceae): This semiparasitic annual species is a common root parasite in the dry prairies in sandy soil. It occurs on native prairies and also on ranches. Occasionally it is seen in disturbed roadside ditches or sloughs. See Cannon,[1] Kuijt,[4] and Lytton et al.[6]

Pedicularis macrodonta Richards (Lousewort) (synonymous with *P. parviflora* Smith): This semiparasitic root parasite occurs in eastern Saskatchewan parklands and boreal forest. The roots of this perennial species produce short haustoria, which become attached to the host roots.

P. groenlandica Retz. (Elephant's Head) and *P. labradorica* Wirsing (Labrador Lousewort): Both species are rare in Saskatchewan. They are found in eastern parts extending to northern Saskatchewan. These two perennial species are root parasites, and their habit and parasitism are similar to *P. macrodonta*. For details about haustoria, see Kuijt,[4] Lytton et al.,[6] Maybrook [8] and Piehl.[10]

Agalinis (Agalinis) (three species) and *Besseya* (Kittentail) (one species): These two genera are rare in Saskatchewan. Three species of *Agalinis* (synonymous with *Gerardia*) are known to occur in southeastern parklands and in southeastern boreal forest, and one species of *Besseya* occurs in the Cypress Hills.[5] The three species of *Agalinis* are annuals and reported to be semi-root parasites. The one species of *Besseya* is perennial and it is also a semi-root parasite. For more details, see Lytton et al.[6]

The members of the Scrophulariaceae are interesting with respect to their parasitic behaviour. They are facultative hemiparasites. In nature, the roots of these plants produce haustoria when they come in contact with the host roots. However, under experimental conditions they can also survive and complete their life cycle without the host plants. Similar parasitic behaviour has been demonstrated in some related species.[3, 9]

The parasitic plants form a very small proportion of the entire angiosperms and show no evidence of evolutionary progress. However, they are still highly significant for they, especially the obligate parasites, represent an evolutionary dead end. They depend on other host plants in nature, and if the host plants are in any way threatened, it is obvious that the parasites are also threatened. A good ecological understanding of the host/parasite relationship of the parasitic plant species is ship of the parasitic plant species is necessary to monitor and predict their future population status.

General Suggestion Next time you see or collect plants belonging to the Figwort family (Scrophulariaceae), make it a point to check their roots carefully for root haustoria.

The authors gratefully thank Dr. G.F. Ledingham, curator of the George F. Ledingham Herbarium, for permitting us to examine the herbarium specimens.

Literature Cited

1. CANNON, W.A. 1909. The parasitism of *Orthocarpus purpurascens* Benth. *Plant World* 12:259-261.

2. DOBBINS, D.R. and J. KUIJT. 1973. Studies on the haustorium of *Castilleja* (Scrophulariaceae). I. The upper haustorium. *Can. Jour. Bot.* 51:917-922.

3. HECKARD, L.R. 1962. Root parasitism in *Castilleja. Bot. Gaz.* 124:21-29.

4. KUIJT, J. 1969. The biology of parasitic flowering plants. University of California Press, Berkeley and Los Angeles, USA.

5. LOOMAN, J. and K.F. BEST. 1979. Budd's flora of the Canadian prairie provinces. Supply and Services Canada, Hull, Quebec.

6. LYTTON, J., F.L.S. MUSSELMAN and W.C. DICKISON. 1975. The structure and development of the haustorium in parasitic Scrophulariaceae. *Bot. Jour. Linn. Soc.* 70:183-212.

7. MALCOLM, W.H. 1966. Root parasitism in *Castilleja. Ecology* 47:179-186.

8. MAYBROOK, A.C. 1917. On the haustoria of *Pedicularis vulgaris. Ann. Bot.* 31:499-511.

9. NWOKE, F.I.O. and S.N.C. OKONKWO. 1974. Facultative hemiparasitism in *Buchnera hispida* Buch.-Ham ex D.Don. *Ann. Bot.* 38:993-1002.

10. PIEHL, M.A. 1963. Mode of attachment, haustorium structure and hosts of *Pedicularis canadensis. Amer. Jour. Bot.* 50:978-85.

11. ——. 1965. The natural history and taxonomy of *Comandra* (Santalaceae). *Mem. Torrey Bot.* Club 22:1-97.

12. RAJU, M.V.S. and T.A. STEEVES. 1962. The Dwarf Mistletoe, A plant parasite. *Blue Jay* 20:82-84.

13. SAUERBORN, J. 1991. Parasitic flowering plants — ecology and management. Scientific Books, Verlag Josef Margraf, Weikersheim, Germany.

14. SHOSTECK, R. 1974. Flowers and plants — an international lexicon with bibliographical notes. The New York Times Book Company, New York.

A gentle breeze of just over 2 miles an hour will carry a female Gypsy Moth's scent almost 3 miles. *The Marvels of Animal Behavior. National Geographic Society.*

WHERE HAVE ALL THE LILIES GONE?: A POPULATION STUDY

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John Macoun describes the prairie at the north end of Last Mountain Lake ("Long Lake"), Saskatchewan in the first week of July 1879 as follows: "Flowers are a most conspicuous feature of the prairie ... Sometimes, lilies (*Lilium philadelphicum*) are so abundant that they cover an acre of ground, bright red. At others, they are mixed with other liliaceous plants, such as *Zygadenus glaucus* [White Camas] and form a ring around the thickets which we passed."[3]

In stark contrast to Macoun, we tend to think of the lily as rare today, perhaps even endangered. Yet, as recently as 1941, when the Western Red Lily (*Lilium philadelphicum* var. *andinum*, also known as the Prairie or Western Wood Lily), was chosen as our provincial flower, it was selected because of its abundance, as well as its flamboyant beauty. Has something happened to lily populations in recent years? Why do lilies bloom in such profusion some years and then seem to disappear? It was questions such as these that inspired us to study lily populations.

The Study We began our study in 1993 and 1994 by tagging a small number of flowering lilies in two field locations where the plants were blooming — the edge of an alkali slough east of the Strawberry Hills, 30 km east of Saskatoon (Sites 1 and 2) and in an upland meadow near the South Saskatchewan River, southwest of Pike Lake (Site 3). In 1995 and 1996, we set up study plots of 12 m^2 each in these locations which allowed us to plot accurately the location of individual plants for long-term observation. We also expanded the study in 1995 to include several sites at Last Mountain Lake National Wildlife Area (LML-NWA) where we could compare lily populations in burned and unburned habitats.

Each site was visited at least twice a year. One visit was during the flowering period in late June - early July to see which of the tagged lilies produced flowers and to tag any new plants that had appeared. Another visit was in late summer to observe what happened over the growing season to the plants that had flowered earlier. We were particularly interested in how many flowering plants survived to produce seed pods, what happened to those that flowered but failed to set seed, and whether plants that flowered one year reappeared as flowering plants the next year.

Different Forms of the Lily Plant When we began the study we were able to recognize lilies only when they were in flower, but while making observations of lilies at our sites, we came to recognize two other forms of the plant. The "vegetative" form is a non-flowering plant consisting of a delicate upright stem with slender leaves and no signs of flower development. The other non-flowering form has a taller, more robust stem

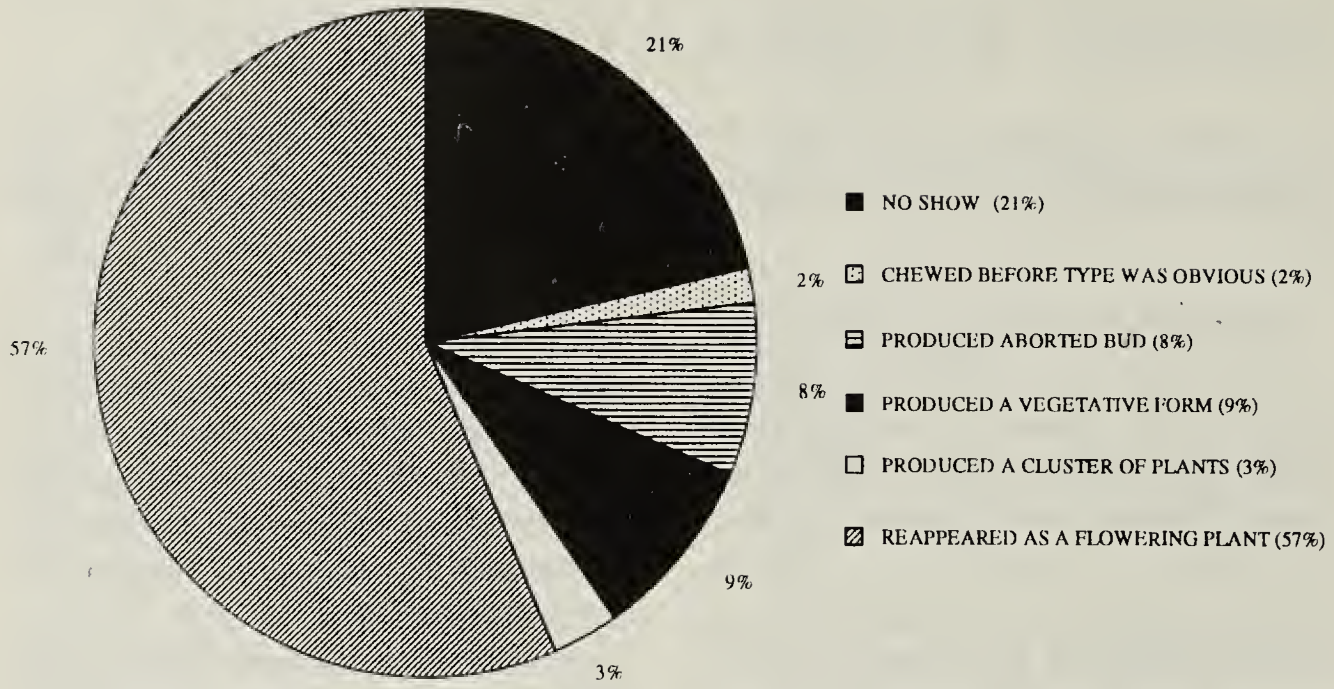

Figure 1. Fate of flowering plants from one year to the next (n=122).

than the vegetative form and what looks like a vestigial, undeveloped flower bud at the top of the terminal whorl of leaves. We call this form "aborted bud" because it appears that the plant was ready to send up a flowering stem but stopped the flowering process at an early stage.

In our survey of what happens to lilies from one year to the next, we discovered that individual lilies can appear in different forms in subsequent years. In addition, a plant may not grow at all for a year or two and then reappear. Slightly over half of the 122 flowering lilies for which we have data for two or more years, flowered again in the second year (Fig. 1). A little less than a quarter did not grow at all in the second year (no show), and the remainder grew as vegetative or aborted bud plants. A few of the individual flowering plants reappeared as tightly spaced "clusters of plants" that were composed of a variety of vegetative, aborted bud and/or flowering forms. We lack information on a small percentage of plants that reappeared but had their stems cut off near the base by mammals (these plants are referred to as "chewed") before we could determine their form. We don't know what causes the plants to change form from year to year. We do know that practically every sequence of forms occurs, including going from a vegetative form to a flowering plant and from an aborted-bud plant to a vegetative form, in addition to all the transformations shown in Fig. 1.

Dynamic Lily Populations These changes in form from one year to the next illustrate the dynamic nature of lily populations. A different subset of individuals flowers each year. Some that have flowered for several years disappear completely and lilies not previously seen in any form, appear as flowering plants. Of the 78 flowering plants tagged at four of our sites in 1995, 17 failed to reappear in 1996 but there were 94 occurrences of new flowering plants.

Thus, in any given year, the visual impression of the number of lilies

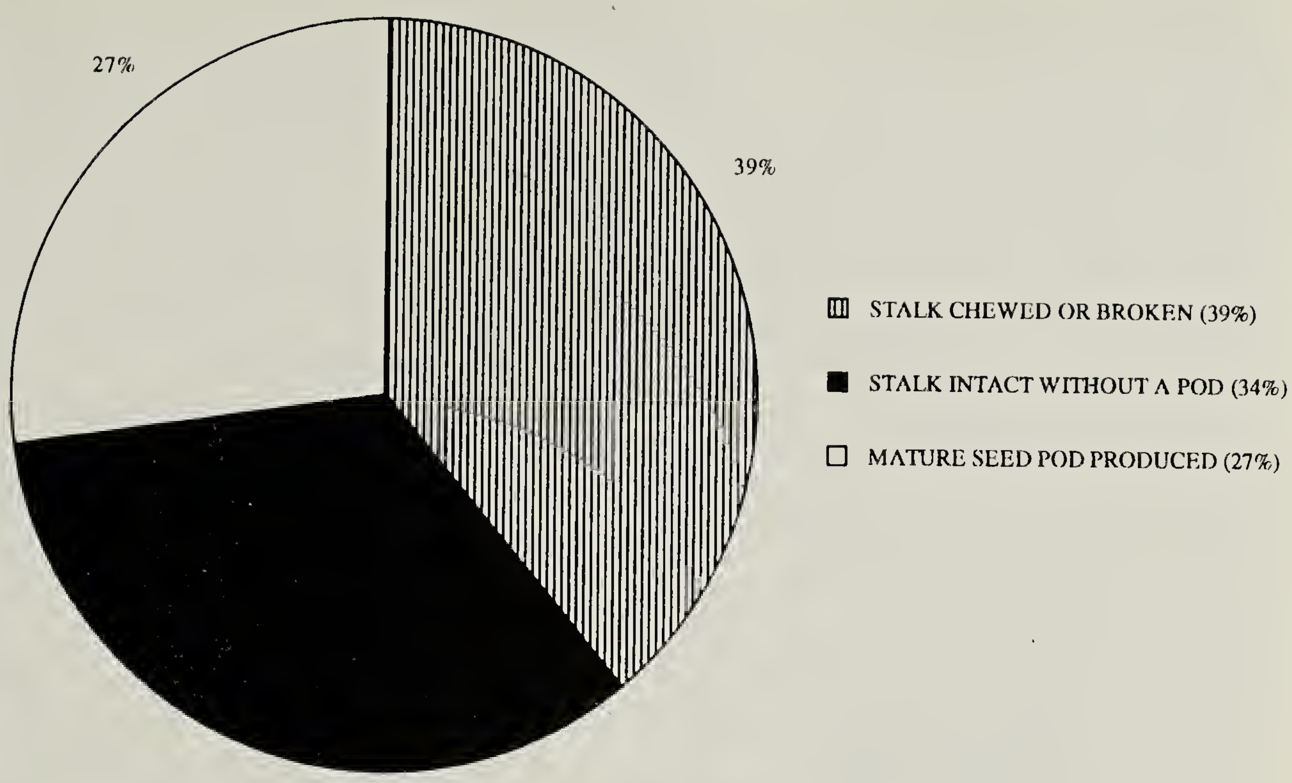

Figure 2. Fate of flowers within one season (n=291).

blooming does not give an accurate measure of the total lily population. Vegetative and aborted bud forms tend to be overlooked by the casual observer and some plants persist from year to year as bulbs. In good lily years, when conditions are right for flowering, many of these plants will flower in bright abundance; in poor years, there may be no flowering plants at all. An example of an apparent disappearance of a lily population was observed by Doris Silcox in 1985 and 1986, following a two-year decline in the number of flowers. In 1987, the lilies in this population started to bloom again and she noted that, "The lily patch at the roadside made a remarkable recovery with 43 red lilies and three yellow lilies."[5]

Production of Seed Pods Flowers are the most noticeable part of the lily plant, but long-term survival of the population depends on successful seed production. Our observations on what happened to individual flowering plants in the course of the growing season suggest that lilies have a low rate of reproductive success as measured by production of mature pods (Fig. 2). Fewer than one-third of the 291 flowering plants for which we have information produced mature seed pods. Slightly more than one-third of the flowering stalks were chewed off or broken before the pods developed and almost one-third retained the flowering stalk but failed to produce a pod. In some cases, there was no sign of any pod development; in others, a small, desiccated pod failed to mature.

The high proportion of flowering stems chewed off before setting seed is a reflection of how palatable lilies are to mammals. The lilies in our plots were eaten primarily by rodents, judging by the height of the stalks left behind after chewing: around 6.5 cm at Site 2 and 12 cm at LMLNWA. Deer are also known to eat lilies, especially the buds,[2] leaving a taller stalk. Chewing by small mammals appears systematic and thorough, but never affected all the lilies in a population. It can however, significantly decrease the overall amount of seed production. At Site 2, 67% of the 49 flowering plants were chewed off in 1995.

Small mammal activity seems to

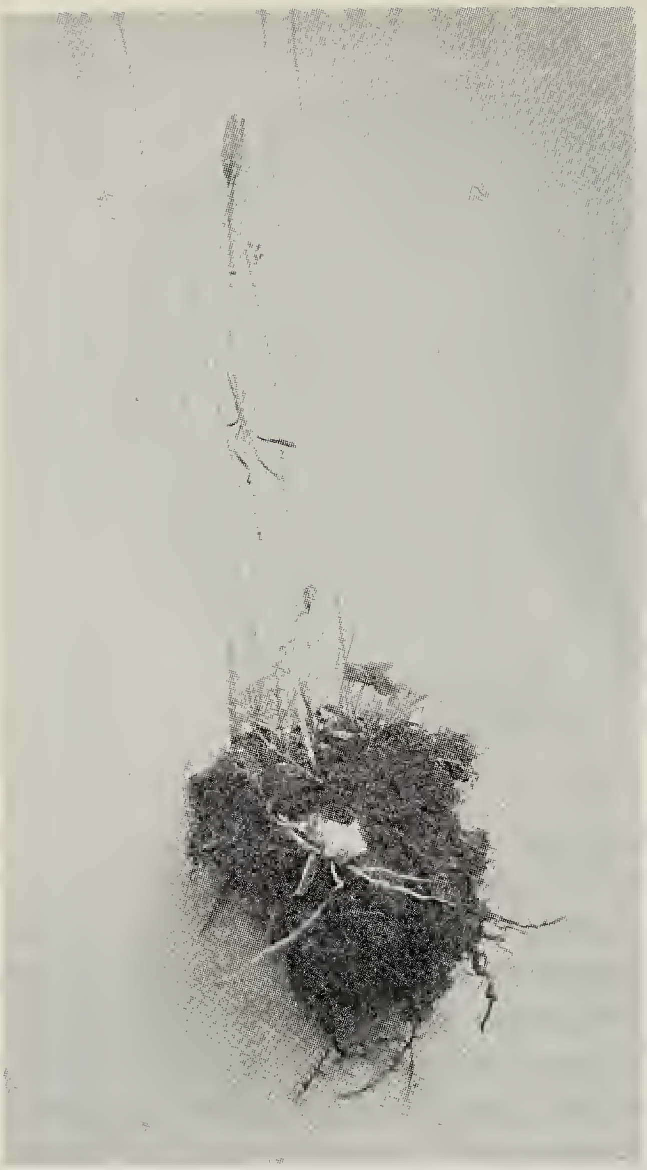

Figure 3. Exposed bulb with intact lily stalk. Anna Leighton

be related to the density of vegetative cover. At two LMLNWA sites with dense vegetation cover, 88% of the 52 flowering stalks were chewed off in 1995 and 1996. In contrast, there was no evidence of small mammals in a LMLNWA site that had been burned in the spring of 1996, removing the vegetative cover.

Vegetative Reproduction Lilies, like most plants, are not limited to reproduction by seed, and in fact have tremendous potential to reproduce vegetatively. Mature lily bulbs are composed of several dozen easily detached bulb scales, each of which can produce a new plant. The bulb is about 5 cm below the soil surface (Fig. 3). Lily bulbs often have an older portion from which the base of the current flowering stalk arises and a newer portion from which the next stalk will grow (Fig. 4). The number and the form of the bulb scales removed from each of these portions is shown in Figure 5. Note that some of these scales consist of two parts (jointed scales) and that both parts can grow a new plant. Jointed scales are particularly important in vegetative reproduction, as the top part detaches readily with minimal disturbance. A young lily plant growing from a non-jointed bulb scale is shown in Figure 6.

Rodents and Lily Bulbs It has been reported in the literature that voles eat lily bulbs. Stuart Criddle described stockpiling of lily bulbs by the Prairie Vole, *Microtus ochrogaster minor.* "The [vole's] store room was only about a third full of what appeared to be lily bulbs. However this was not the case, as when the contents were sorted out and counted, I found it to be composed of the following; 1176 lily bulbs (*Lilium philadelphicum*); 678 wild onion bulbs (*Allium stellatum*); 583 pieces of the rhizomes of sunflower (*Helianthus rigidus*); 417 buds and pieces of the taproot of pasque-flower (*Pulsatilla ludoviciana*)" in addition to bits and pieces of several other plants. The lily bulbs made up 79% of 2648 grams of the total plant material. [2]

John Richardson lends support to this observation when he says that *Lilium philadelphicum* is "termed by the Crees, *Appecooseesh-ootchoepeh* (Mouse-root) because the common mouse of the country, a species of Campagnol, feeds upon its scaly bulb."[4]

Observations at Site 2 led us to wonder about the effects of pocket gophers on lily populations. These animals tunnel underground in search of roots to eat and store for

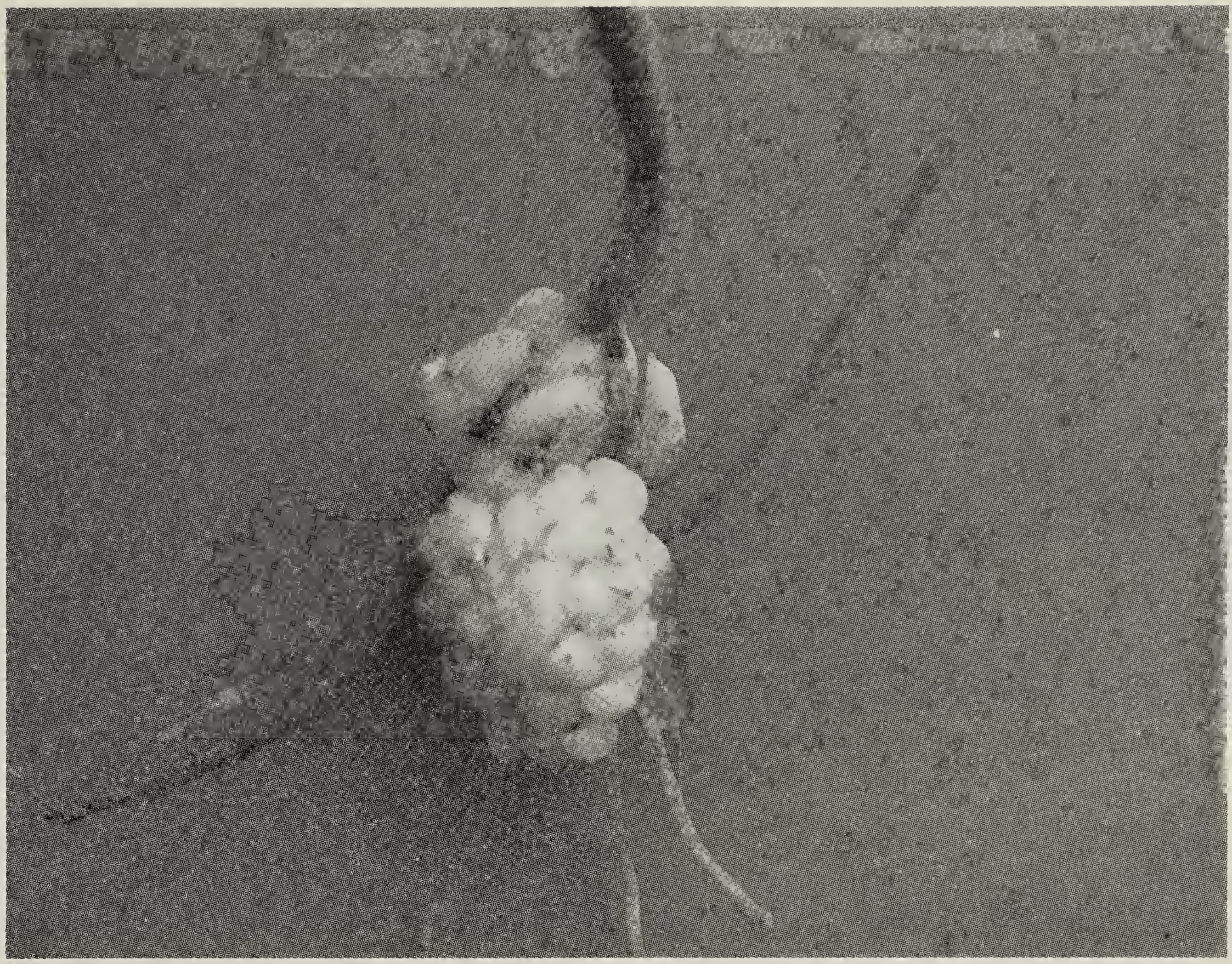

Figure 4. Same bulb with soil removed. Left hand arrow indicates the older portion of the bulb with an attached flowering stalk. Right hand arrow indicates the newer portion of the bulb. Anna Leighton

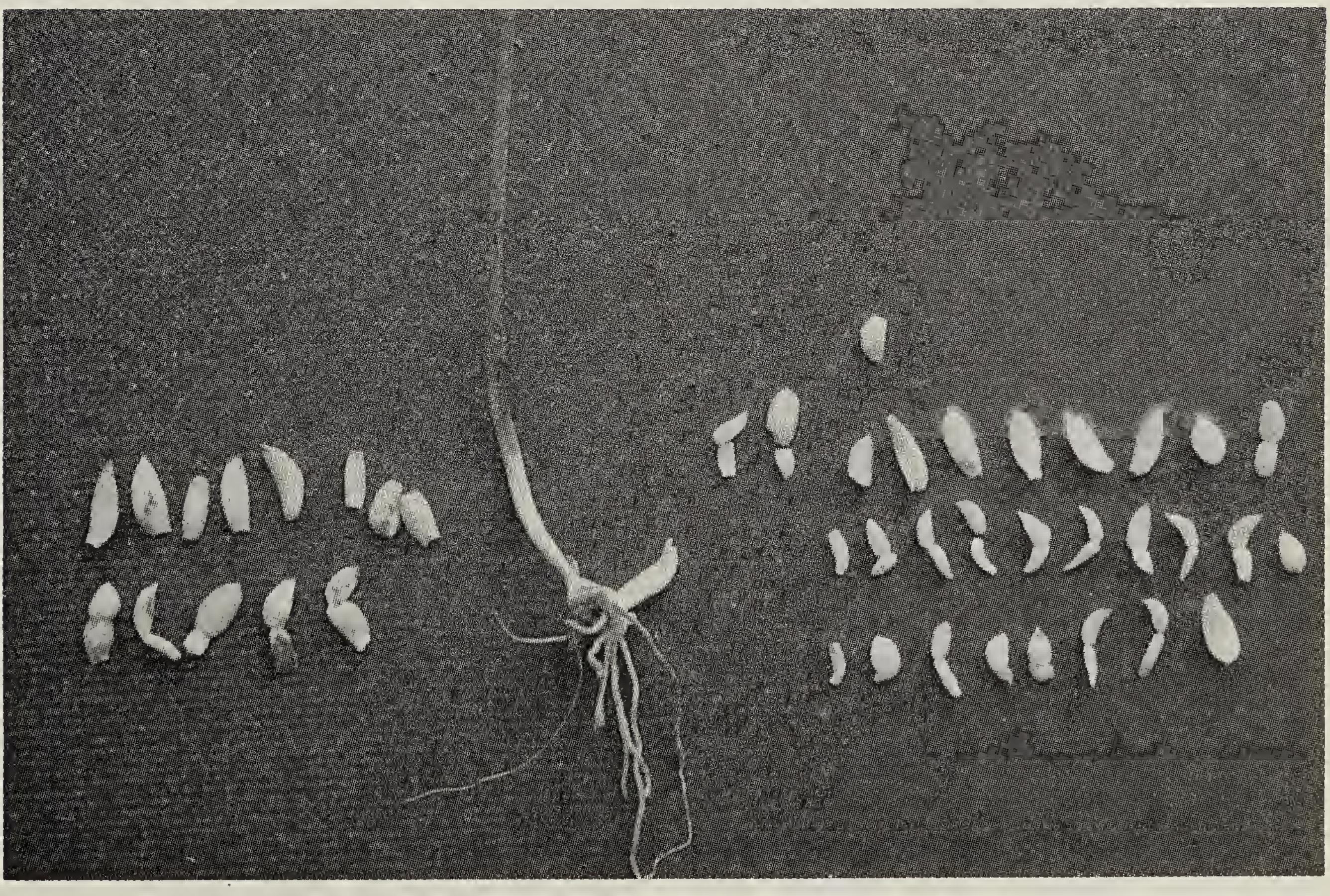

Figure 5. Bulb scales removed from the same bulb. Bulb scales of the older portion are on the left; those of the newer portion, on the right. The arrow indicates a row of jointed scales. Anna Leighton

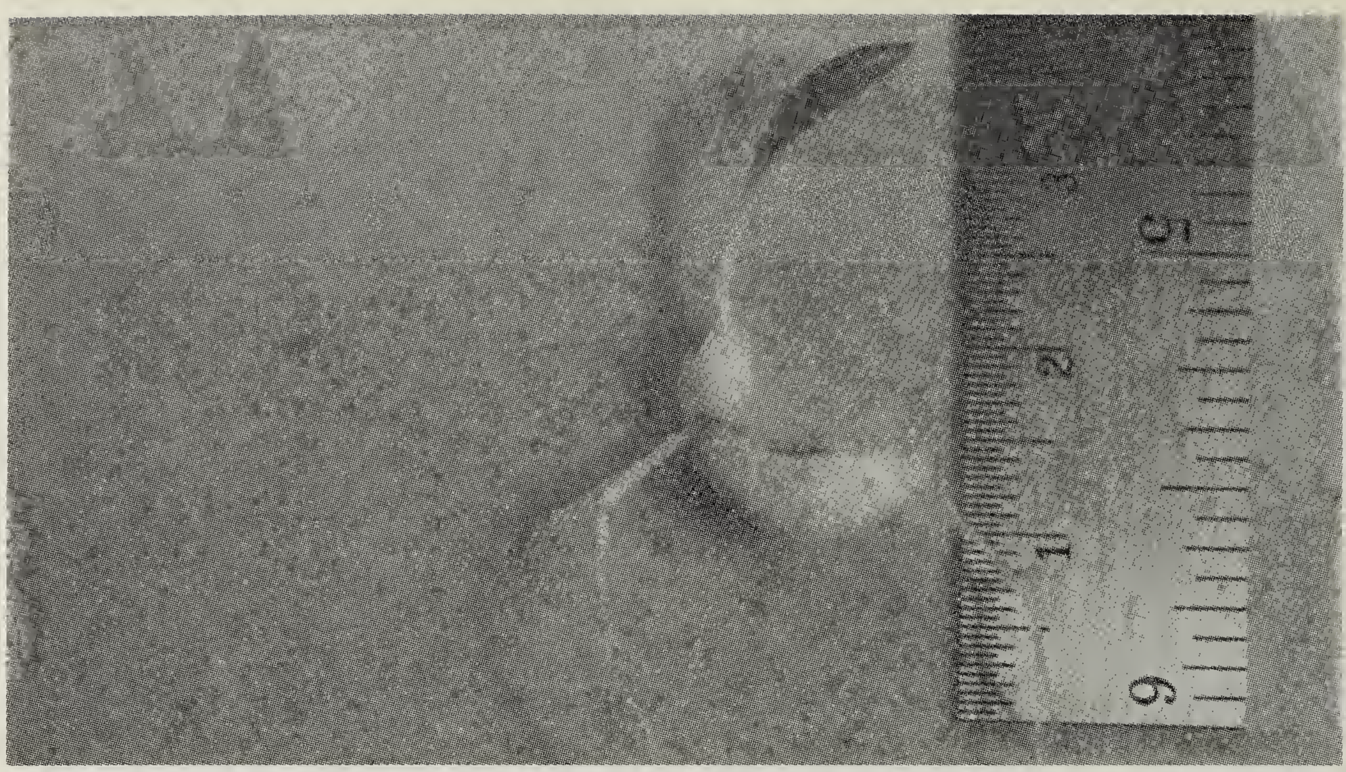

Figure 6. Young lily plant growing from a non-jointed bulb scale. Anna Leighton

winter. Criddle's excavations of five stores of at least three different pocket gophers in late October and early November did not reveal any lily bulbs, but he observes that pocket gophers will eat whatever is growing near their burrows and that "there is little actual preference in the selection of food, but that the roots are taken as encountered."[1]

Pocket gophers had burrowed extensively in and around the plot at Site 2 in 1993. Two years later, we noted a large number of new plants, one-half of which were vegetative and could very likely have grown from detached bulb scales in the intervening two years. This plot had the highest density of lilies (an average of eight lilies per metre square in 1995) that we have observed in any of our plots. We speculate that if pocket gophers were eating or transporting bulbs underground, the detachable scales would have broken off and, once separated from the main bulb, would have grown into new plants.

Conclusion This article presents observations on the natural history of the Western Red Lily that help explain fluctuations in numbers of flowering plants in a given population, namely the change in form of lily plants from year to year and the chewing of plants by mammals. In terms of the overall impression of the number of lilies flowering in Saskatchewan in any one year, other factors are important. One of these is weather. Over the last three years, the number of lilies counted in three sites has steadily increased, an increase which we attribute, in part, to increased moisture at certain times of the year.

Probably the most important factor to affect lilies in Saskatchewan, however, is the destruction of native prairie by cultivation. Lilies increase and decrease in response to other factors, but cultivation simply eliminates whole populations. In addition, the now scattered remnants of prairie present problems for management of plants like the lily which may require periodic disturbances such as fire for long-term survival.

We are just beginning to gain some understanding of this plant's some understanding of this plant's life history and how it survives in Saskatchewan. There is a great deal more to be learned, such as how long individual plants live, at what age or stage of development they begin to flower and what triggers the flowering process. We plan to continue our field studies for another six years and have already begun greenhouse propagation experiments and a program of planting lilies of known age back into the wild for observation. This research should provide information about our provincial flower that will be both interesting and important in managing areas with existing lily populations.

We would like to close with a quote by the Earl of Southesk which describes a bloom of lilies near Qu'Appelle in 1859: "Sometimes acres and acres were covered with intermingled masses of the orange lily and the pendulous blue-bell, the whole of them so short of stem that the glory of the flowers combined with the rich greenness of their leaves, and it seemed as if a vast oriental carpet had been thrown upon the ground."[6]

We welcome comments from readers about lilies. We can be reached by mail using either of the authors' addresses at the beginning of this article, by e-mail at fleighto@eagle.wbm.ca or by phone at 373-8674 (BL) or 665-6074 (AL).

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1. CRIDDLE, STUART. 1930. The prairie pocket gopher, *Thomomys talpoides rufescens. Journal of Mammology* 11(3): 265-280.
2. ——. 1947. *Microtus minor* and the Prairie Lily. *Canadian Field-Naturalist* 61:116.
3. MACOUN, JOHN. 1979. Autobiography of John Macoun, M.A. Ottawa Field-Naturalists' Club, Ottawa.
4. RICHARDSON, JOHN. 1823. Botanical appendix. *In*: FRANKLIN, JOHN. 1823. Narrative of a journey to the polar sea, in the years 1819-20-21-22. John Murray, London.
5. SILCOX, DORIS and VERNON L. HARMS. 1989. The Yellow Immaculate Lily in Saskatchewan and adjacent Manitoba, and its persistence in native lily patches. *Blue Jay* 47: 69-73.
6. SOUTHESK, JAMES CARNEGIE. 1875. Saskatchewan and the Rocky Mountains: a diary and narrative of travel ... in 1859 and 1860. Edinburgh. Cited in DOWNIE, MARY ALICE and MARY HAMILTON. 1980. 'and some brought flowers,' Plants in a new world. Toronto University Press, Toronto.

THE RED FOX INVASION AND OTHER CHANGES IN WILDLIFE POPULATIONS IN WEST-CENTRAL SASKATCHEWAN SINCE THE 1960s

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After reading the note about foxes by Sig Jordheim,[5] I am prompted to respond. Mr. Jordheim saw and killed the first wild Red Fox in November 1966 near his farm at Kyle, and he notes that they became very plentiful in the 1970s and 1980s. He observed that the increase in the fox population coincided with a great decline in jackrabbit populations. He wondered whether the foxes had originated from a fur farm that had operated in the area between 1930 and 1941.

I vividly recall the first Red Fox I had ever seen in the Luseland area (about 180 km northwest of Kyle). It was in the early winter of 1964 or 1965. My father shot it. Within a few years foxes had become common, and by the early seventies they had become a plague. I believe that the explosion of the fox population was a case of nature filling a niche left vacant by Coyotes, and that, ultimately, it was caused by the introduction of the snowmobile in the early 1960s. Nora Stewart[9] of Craven, SK reported on the slaughter of Coyotes in the late 1960s (around 10,000 a year!), and noted that there had been a "tremendous increase in foxes along with the decrease in Coyotes in Saskatchewan since the late 1950s." She suggested that the decline of Coyotes was due largely to poisoning programs, but in our area, the decline was almost certainly due to the use of snowmobiles. Whatever the cause, the decline of Coyotes is, I believe, one of the most important factors, along with habitat loss, that has affected wildlife populations on the prairies in recent times. Stewart [9] asked the prescient question "What is the balancing effect of the Coyote on the Red Fox population?" and she lobbied the provincial government for protection of the Coyote but with little effect.

Hunting Coyotes was a family activity that was as much a part of my prairie childhood as shooting gophers or crows on a Sunday afternoon. It was a deeply ingrained prejudice that I did not question, that is, until the slaughter by snowmobiles began. I remember the fur trucks from North Battleford, parked on Main Street, stacked high with the frozen corpses of Coyotes and jackrabbits. I recall the feeling of helpless rage as I watched a "snowgoon" chase a Coyote to exhaustion on the ice of Grass Lake, then run over it repeatedly before leaving it to limp away and die. Later, I found the battered body in a ravine, and photographed it with the intent of documenting the atrocity (see accompanying photo). Judging from the bragging of my classmates, the

Red Fox vixen with kits

Larry A. Morgotch

atrocity was widespread and unquestioned, and because the culprit was a respected citizen, I did not take legal or moral action.

The big plains Coyote, *Canis latrans latrans*, (which is a very different animal in form and behaviour from the "brush" Coyote of the north and eastern Canada) didn't stand a chance against the snowgoons. Unlike the wily foxes, these denizens of the open country had no defences except to try to outrun the snowmobiles; foxes simply lay down in the stubble or buck brush, or scurried under a bin or into a culvert. By the late 1960s, Coyotes in our area had been eliminated from all but the most inaccessible parts of their range, for example, Hearts Hill and Muddy Lake hills and the PFRA pastures.

Coincident with the explosion of the fox population, we (my family) began to notice major changes in other wildlife populations. Burrowing Owls and Sharp-tailed Grouse disappeared. The numbers of Gray Partridges dropped sharply; flock size was often only 4-5, compared to the usual 15-20. We began to conduct Christmas bird censuses in 1971, but it was already too late to document the changes in grouse and partridges.[3] Duck populations also declined, due in part to drought and habitat loss, but judging from the offal around their dens, foxes took a large number of nesting females. Foxes are recognized as the principal predator of nesting ducks and many ground-nesting birds in prairie pothole country.[4,7] I believe that populations of Western Meadowlarks, Killdeer, Avocets and several other species also declined due to fox predation. Unlike the plains Coyote, which specializes in hunting jackrabbits and small mammals, foxes are opportunistic predators and take a wider range of prey.

Small mammal populations also

declined. Jackrabbits all but disappeared. In the early sixties there were winter "rookeries," where over a hundred rabbits could be flushed from a willow-fringed slough. Today they are uncommon. Whereas, Coyotes occupy large home ranges (e.g. 60 km^2), and tend to remain in balance with jackrabbit populations,[6] fox densities are generally much higher (e.g. home range about 12 km^2) because of their smaller size and opportunistic foraging strategy.[8] In 1981, a local trapper reported that he took over 40 foxes within about a 2-3 km radius of Luseland.[3] I believe that few young jackrabbits survived due to the high densities of foxes. The decline of several species, was probably exacerbated by habitat loss, but I believe that fox predation was a more important factor in many cases. Interestingly, White-tailed Jackrabbits, Sharp-tailed Grouse and Gray Partridges were most abundant in the areas where Coyotes and prairie persisted.

Foxes also had a significant influence on prairie farm culture. Farmers found that they could no longer easily raise free-range chickens. Foxes would attack even in the middle of the day. Most farms used to have a flock of chickens; now relatively few farmers bother to feed the foxes, and good free-range chicken is only a fond memory.

I agree with Jordheim that foxes have declined in the last few years. He implies that disease such as mange is responsible but I believe that it is because the Coyote population is increasing, and Coyotes are known to kill foxes.[10] In fact, interspecific strife is believed to be the main reason why foxes occur close to human habitation, and avoid open country where Coyotes live.[1] Ultimately it is the change in our attitudes that is bringing back some balance; it is no longer considered socially acceptable to run down Coyotes with snowmobiles. Indeed, it is heartening to see that people's attitudes towards wildlife have changed a lot within a generation; shooting gophers, hawks and Coyotes is no longer a Sunday afternoon sporting event.

My family and I have observed other major changes in mammal populations over the last few decades. Both species of deer, which were rare during my childhood (1950s and 1960s) or my father's (1930s and 1940s), have become quite common. White-tailed Deer were the first to increase, and Mule Deer have become more common in the last two decades. It is possible that their increase was due to a reduced Coyote population (Coyotes are significant predators of young ungulates), but I believe that it is also due to a growing appreciation of wildlife in rural areas, and protection from hunting.

Pronghorn have recently moved into this area; Luseland is near the northern apex of the Palliser Triangle and the range of the Pronghorn. Before settlement, they occurred in the area, but until about 1980 they were rarely seen north of highway 51 (Biggar-Kerrobert). Around 1980, my father was surprised to see a small group on his farm. They disappeared during the winter but at least 11 returned in 1982, and some young were raised. During the first few years the Pronghorn apparently migrated away during the winter but eventually a few remained year round. The population grew to about 75 or 100 animals by 1989, and remained very attached to its original home range, an area of heavy dark soils along a glacial valley (Grass

Coyote killed by snowmobiler, December 1975 *K.J. Finley*

Lake). This area is intensively cultivated, with very little native prairie, and the Pronghorn used slough bottoms where Sow Thistle and other forbs predominated. They became very accustomed to farm machinery and my family and many farmers greatly enjoyed their presence.

Then, in 1990, the Department of Parks and Renewable Resources opened a Pronghorn season in this area for the first time ever, without any knowledge of the population size and without consultation with local farmers. The effects of the season were devastating to the herd, which had become highly visible along Highway 21 (Kerrobert-Unity). They had become very tame and were slaughtered despite the attempts of several farmers to protect them. The hunters wanted only the big bucks; we heard of at least three does that were left in the fields. Very few antelope returned in 1991, and we were discouraged by the situation. We wrote letters to the minister and met with provincial wildlife biologists. It was clear that the department had no information on which to base a sustainable hunt, and that their policy was dictated primarily by the mandate to increase the number of hunter recreation days.

My brother-in-law (Brent Honeker) wrote to the minister: “I expect that aesthetic values of wildlife register minimally in your equation. How can you weigh the value of a trophy antelope head on someone’s wall with the many person-years of pleasure that we, the majority of local people, derive from this resource? You may appreciate that this prairie landscape is monotonous enough at times and that wild antelope are a welcome pleasure.” Despite our strong complaints the hunt continued in 1992, and the herd (what little was left) was further devastated. My brother (Kim Finley), who was then a representative with SNHS, took this issue to the annual meeting and a resolution was passed, requesting that the hunt be stopped. It was stopped in 1993 and has remained closed, but it seems that the social structure of the herd has been damaged. Only a few scattered individuals remain today. The landscape is more monotonous without them, and we are much poorer for it. After this sad experience, I believe that the department does not properly represent our best interests in wildlife conservation, but is controlled largely by the economic value of wildlife to sports hunters.

On a brighter note, we have experienced another invasion. Over the last couple of decades there have been occasional sightings of Moose, but in about 1990 or 1991, sightings became more common, and now it seems that Moose have become residents. This seems strange considering that there is relatively little bush cover (aspen groves probably cover less than 3% of the area), but apparently the Moose are quite happy to occupy slough bottoms with willows. It is remarkable how inconspicuous they are; few people would guess that they inhabit this country. In late May of 1995, I was surprised to find a female Moose in a small (1 hectare) willow-fringed slough in the middle of an extensive wheat field. She had just given birth to a calf, her second. Judging from the amount of browsing, it was apparent that she had occupied the slough for some time. Given a chance, this first generation may be able to adapt to the open prairie.

Lately, folks have taken to driving the country roads in the evening, watching for wildlife. As my parents say, "They add life to the landscape and bring hope to the imagination. Where else do the deer and the Moose and the antelope play?"

In closing, I conjure up a Larson image of an old codger in his rocking chair, pontificating "Yup, you should have seen it, clouds of ducks, herds of jackrabbits, burrowing owls." Sad truth is that the new generation has little knowledge of prairie life before the fox invasion, and what little knowledge there is, may be found only as an anecdote in the *Blue Jay* or in the oral recollections of our pioneers.[2]

1. DEKKER, D. 1983. Denning and foraging habits of red foxes, *Vulpes vulpes,* and their interaction with coyotes, *Canis latrans,* in central Alberta, 1972-1981. *Can. Field-Naturalist* 97: 303-306.
2. FINLEY, K.J. 1972. A 1921 photo of whooping crane. *Blue Jay* 30 : 151.
3. FINLEY, K.J. and K.B. FINLEY. 1982. A decade of Christmas bird counts in the aspen parkland. *Blue Jay* 40: 31-33.
4. JOHNSON, D.H., A.B. SARGEANT and R.J. GREENWOOD. 1988. Importance of individual species of predators on nesting success of ducks in the Canadian prairie pothole region. *Can. J. Zool.* 67: 291-297.
5. JORDHEIM, S. 1995. Foxes in south-central Saskatchewan. *Blue Jay* 53: 232-233.
6. MACCRACKEN, J.G. and R.M. HANSEN. 1987. Coyote feeding strategies in southeastern Idaho: optimal foraging by an opportunistic predator? *J. Wildl. Manage.* 51: 278-285.
7. RUDE, K. 1991. Outfoxing predation. Ducks Unlimited. May-June. 57-65.
8. SARGEANT, A.B., S.H. ALLEN and J.O. HASTINGS. 1987. Spatial relations between sympatric coyotes and red foxes in North Dakota. *J. Wildl. Manage.* 51:285-293.
9. STEWART, N.M. 1969. Coyote management in Saskatchewan: is poison the answer? *Blue Jay* 30: 138-145.
10. VOIGHT, D.R. and B.D. EARLE. 1983. Avoidance of coyotes by red fox families. *J. Wildl. Manage.* 47: 852-857.

INSECTS

THE DRAGON FLIES...

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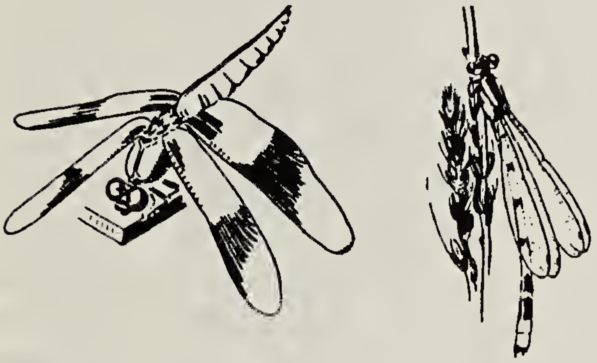

Figure 1. Dragonfly and damselfly (from Needham and Westfall, A manual of the dragonflies of North America, *1955).*

The dragon flies, or so it must seem to a mosquito about to be grasped by a dragonfly for its next meal. Dragonflies and damselflies are closely related groups of insects (collectively called odonates and often referred to solely as dragonflies). They are most easily told apart when they perch: the bulkier dragonflies keep their wings straight out from the body, whereas the more delicate damselflies bring theirs back together above the body (Fig. 1).

The 5500 species of odonates are distributed around the world. They are most abundant in the tropics but also occur within the Arctic Circle. In the prairie provinces there are some 25 kinds of damselflies and 60 dragonflies. The smallest of the small is about 25 mm long and the largest, the Green Darner (mostly blue), about 80 mm with a wingspread of 110 mm and one of our most common dragonflies (Fig. 2).

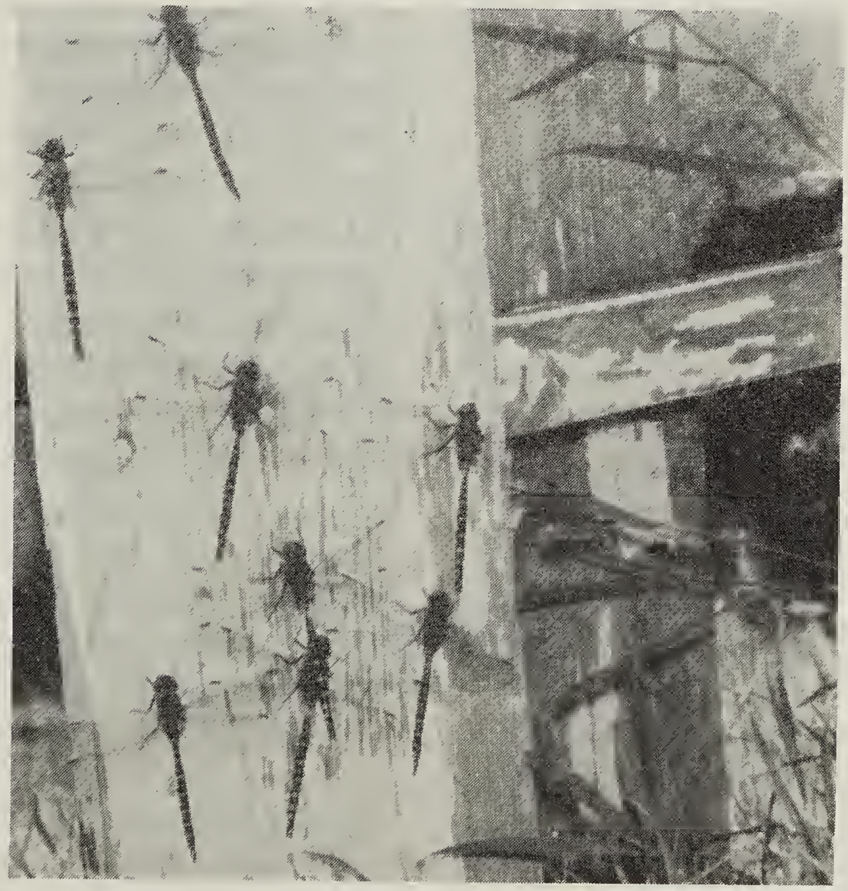

Figure 2. Eight of a cluster of eleven darners on a fence in Saskatoon, July 1996

Bernie Gollop

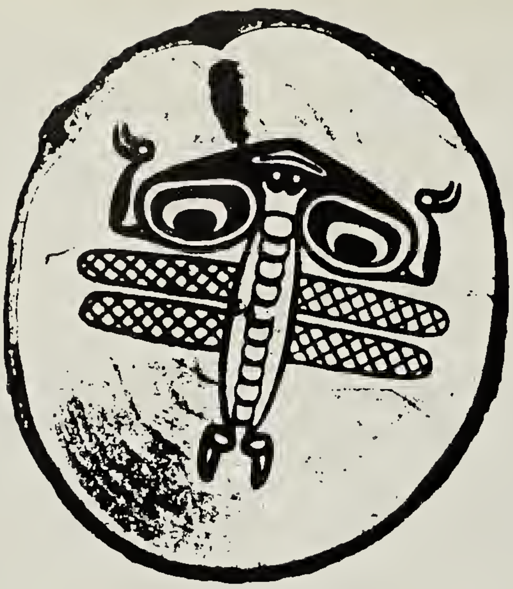

Figure 3. Dragonfly drawing on a slice of tree branch by a Quakiutl Indian, Queen Charlotte Islands, British Columbia.

Dragonflies have been around for 300 million years. Back then they were bigger, with a wingspread of 700 mm. More recently they have become part of native cultures, have served as nose ornaments in Colombia and been relished as food and used for medicinal purposes in southeast Asia (Fig. 3). They have appealed to artists and sculptors and in many countries have been the subjects of stories, poems and songs.

In the March 1975 *Blue Jay*, Dennis Lehmkuhl produced a well-illustrated article on identifying prairie province odonates to families. In the last few years their popularity has increased rapidly among naturalists, with several regional field guides appearing, those closest to the prairies being British Columbia, Ontario and Wisconsin. Can the Peterson series be far behind?

In this story the egg comes first, dipped by some species into fresh or alkali water from the end of the female's body as she is carried along by the male and then left to sink into vegetation (Fig. 4). Other species lay eggs in a hole pierced in a plant stem just above or below the water. If below, the female may stay submerged for up to an hour by absorbing air trapped between her body and wings. The wetland chosen must be fairly permanent because the eggs take one to four weeks to hatch and the strictly aquatic larval stages (nymphs) of fast-developing species need four to seven weeks before they climb out onto a plant stem, split open the "skeletons" holding their bodies together and allow the adults to emerge (Fig. 5). Some species overwinter as eggs while others may spend up to six years under water and ice as nymphs.

When the yellowish adult first emerges (most new emergees are yellow), it remains on its stem as long as an hour until its wings harden and it can fly. Then, for one to four weeks until it matures — doubling its weight and changing its body colour — it wanders away from water, sometimes many kilometres, and often into residential yards

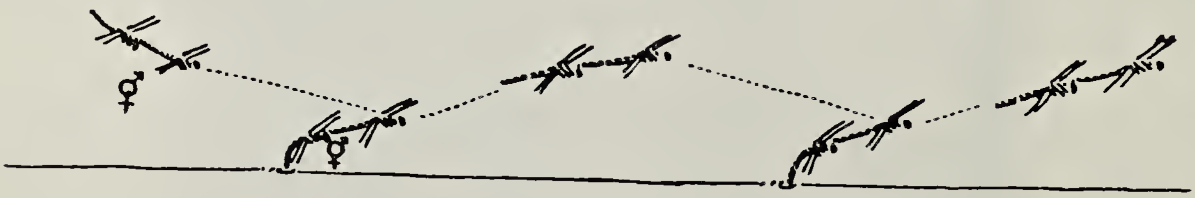

Figure 4. Dragonflies flying in tandem as female drops eggs in the water every few centimetres (from Needham and Westfall, A manual of the dragonflies of North America, *1955).*

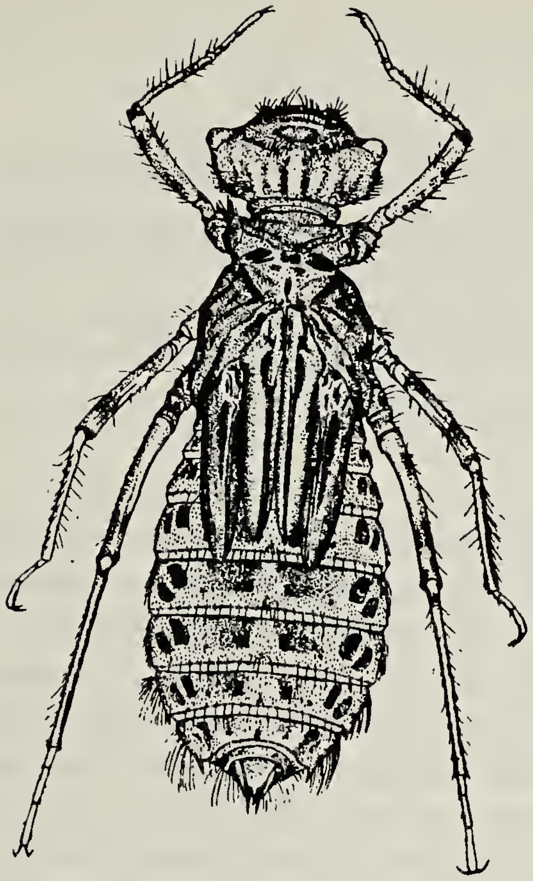

Figure 5. Nymph of dragonfly (from Walker and Corbet, The Odonata of Canada and Alaska, *1975).*

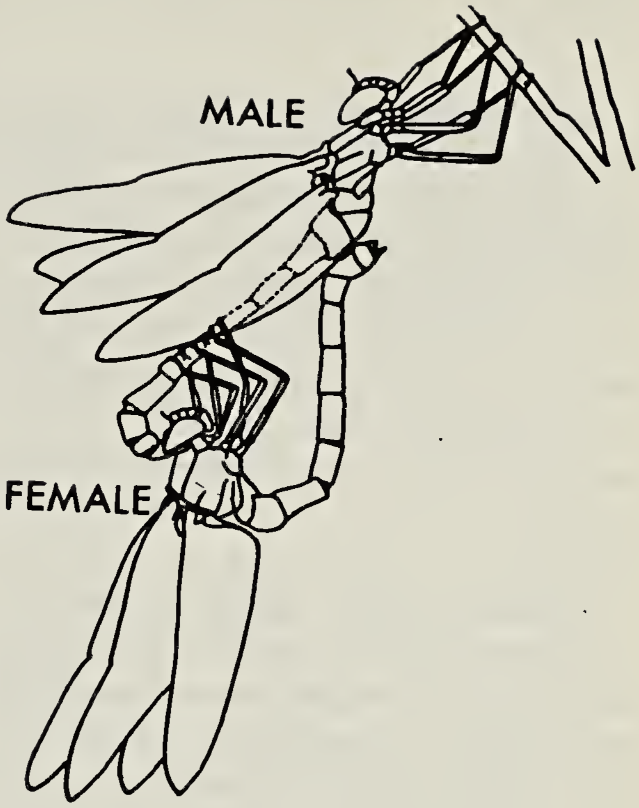

Figure 6. Damselflies copulating (by Art Brooks from Lehmkuhl, in March 1975 Blue Jay*).*

where you may see one or more patrolling back and forth for insects. In the summer of 1996 dragonflies were particularly common in Saskatoon as well as elsewhere in Saskatchewan, according to Doug Gilroy in his "Prairie Wildlife" column in the *Western Producer.*

When they return to water, males set up territories, from as small as 2 m long and a metre wide up to several hundred square metres, along slough, lake or stream. The variation depends on species, size of the dragonfly and population density. On the other hand, some species have no territories and males usually hunt for females over land. After a brief courtship, the pair mates, with the male taking hold of the heavier female just behind her head by using the claspers at the end of his body. Copulation follows and may last from a few seconds to five hours, during which time the female receives sperm from the male (Fig. 6). Between May and October she may lay from 200 to 2000 eggs of which about one in 100 becomes an adult with a life span of six to ten weeks — all depending on the species and environmental conditions.

Some dragonflies move great distances, sometimes unpredictably, as in the invasion of Ireland by "countless thousands" of a subspecies found only in Spain and Portugal, 800-1000 km (500-600 mi.) away. Other movements are regular migrations, north and south, reported mainly from the east coast where dragonfly-watches, like hawk-watches, are being set up. Near New York City, 13 species of dragonflies (no damselflies) migrated southward between 30 July and 14 November, with the highest one-day count for a species being 2420. If anyone knows of odonate migrations in the prairie provinces, I would appreciate hearing about them (phone 306-343-1027).

Like butterflies, the majority of odonates are at their best in warm weather, being most active on sunny afternoons and usually landing if a cloud casts a shadow. However, some species fly at dawn and dusk, while a few are actually nocturnal. Overnight they rest, usually perched vertically, from grass-height to tree-height.

Fierce as they appear up close, dragonflies are incapable of stinging and bite only when they consider themselves adequately provoked. With larger eyes in relation to body size than any other animal and able to fly with great agility forwards, backwards and sideways, as well as to glide and hover, they are particularly adept at preying upon any insect small enough to catch with their legs — larger dragonflies even eating smaller ones. They have been seen hovering carefully in front of spider webs and plucking off the weavers, flying up and down tree trunks and checking crevices in buildings for prey. They probably see in colour and detect small flies at much lower light levels than humans can detect even the dragonflies. They can carry up to 2.5 times their own weight, usually feed in flight and fly up to 35 km (22 mi.)/hour.

For adults, the major mortality factor is weather — prolonged rain or cold upon emergence (death coming from starvation or predation) or strong winds at any time, blowing them over large lakes where they die from exhaustion. In addition, they are preyed upon by animals varying in size from ants (eating adults emerging on the ground) to crocodiles (really!). Frogs are major predators on adults. and birds that eat them range from hawks to sandpipers, kingfishers to swallows. Wasps, robber-flies, spider webs and even the carnivorous sundew plant can also slay the dragon.

* * *

The Reddish Buff moth, *Ascometia caliginosa*, once thought to be extinct in Britain, is saved. Nine years ago a tiny group of moths was discovered on the Isle of Wight. Conservationists cleared land and re-introduced its food plant, Saw-wort, and now there are seven successful breeding sights. This includes a location in adjacent Hampshire, where the moth has not been seen for thirty years. *Daily Mail* (Britain), 17 October 1996.

INTEGRATED FOREST RESOURCE MANAGEMENT: A NEW DIRECTION IN SASKATCHEWAN'S FORESTS?

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According to Saskatchewan Environment and Resource Management, "the people of Saskatchewan want their forests managed differently than in the past." "The challenge," it says, "is to apply the principle of sustainable development to the management of Saskatchewan's forests." The cornerstone of its new forest policy, unveiled in March 1995, is the *Saskatchewan Long-term Integrated Forest Resource Management Plan*. The Plan promises an "ecosystem approach" to provide "multiple benefits" that will be "shared among all uses ... large and small, consumptive and non-consumptive, commercial and non-commercial." Environmental Impact Assessments (EIA) of the Forest Management Licensing Agreements (FMLA) under which major timber harvesters operate will be required for the first time. Is a new era in forest management really beginning? Certainly, Integrated Forest Resource Management (IFRM) is an idea that opens the door to a more ecologically enlightened forest policy. Both governments and the forest industry across Canada are publicly committed to sustainable development. But as Paul Griss, former executive director of the Canadian Nature Federation, warns, "the really tough decisions have yet to be made."

The Saskatchewan IFRM Plan recognizes most of the major stresses on the boreal ecosystem environmentalists and naturalists have been talking about for years. It addresses a wide range of issues and suggests "actions" for five- and 20-year planning. However, the "actions" are not prescriptions so much as a list of topics for further discussion. For example, under the "objective" entitled "Ensure that timber harvesting and silvicultural practices maintain forest diversity and healthy forest ecosystems," ten "actions" are proposed. The following three are given an "essential" priority:

1.1 In consultation with all stakeholders in a given region, set objectives for the proportions of the land available for intensive management as opposed to more extensive management.

1.2 Review and modify the riparian buffer guidelines to include ... buffer widths required for all bodies of water ... [and] renewal strategies for riparian forests.

1.3 In consultation with all stakeholders, develop guidelines which identify timber harvesting and silviculture objectives ... to address the following issues: Maintaining the natural pattern of landscape diversity; Maintaining a variety of disturbance sizes, ... natural proportions of old stands [and] ... suitable habitat conditions for all types of wildlife; ... Avoiding disturbance of rare plants; ... Maintaining corridors of intact forest ... [and] habitat diversity within cut areas; [Establishing] ... preharvest silvicultural prescriptions; ... Modifying harvesting practices [to incorporate] ... forest landscape design principles.

Consultation and public involvement should be part of the planning process, but we have to remember that the forest industry's "consultation" will include efforts to influence public opinion and lobby government. The real test of the new policy will be the way it is applied in the forest management plans drafted by the industry as part of the FMLA's that govern their activities. The guidelines issued by SERM for environmental assessment of management plans are very general. The IFRM plan is mentioned in them only as "background information." Thus the industry has an opportunity to shape the EIA process. Obviously, much will depend on the way the industry interprets and applies IFRM. Major forest companies are now undertaking EIA's. They will be the fulcrum on which the future of our forests turns.

To be acceptable to environmentalists, IFRM must sustain the forest ecosystem in all its diversity. However, there are versions of IFRM with substantial support in industry that place emphasis on sustained harvest of timber. Biological and landscape diversity would be preserved only when it is possible to do so without interfering with the priority given to the forest industry.

Sustained development is a long-term project. Success will be measured over cycles of 75 years or more, the generations of the forest. Market-driven corporate planning takes a shorter view. North American industry is more closely attuned to the quarterly balance sheet than to the life of the forest, and amortizes capital investments over 10- to 25-year periods, not generations of trees. The industry likes to give itself credibility by reminding us that it is "here to stay," with a vested interest in sustaining the resource. But investors are more interested in today's profits than those of their grandchildren. Many people in the industry sincerely care about the future of the forest, but it would be unrealistic to believe that good intentions are a match for the bottom line. As William Osborne observed in a review of the American forest industry: "Like their counterparts in business across the country, pulp and paper mill executives are loathe to spend money on items they feel will not contribute directly to increases in profit or production."

Sustained development will be accepted by the industry as a cost of doing business, not an investment in the future. The cost can be justified to shareholders only if it is imposed on the industry by the public as owners of the resource. Consider the problem of regenerating the forest after harvest. SERM statistics show that 66% of forest lands harvested since 1975 have failed to regenerate to accepted standards. Industry did as much as was demanded of it; because the regulatory system in place asked no more, the backlog of "not sufficiently stocked" forest land grew. Now that the problem has been recognized by government, industry is willing to improve the silviculture effort. But the driving force is not fear of actually running out of trees. Stands planted today will not be harvested for 75 years, if ever. A more short-term calculation has been made: if the regeneration rate is not improved, more stringent harvest limits may be imposed by the regulators.

Exploitation of timber resources is accelerating. The harvest fluctuates with the market for wood, but in each economic cycle, production has reached new highs. In 1979, the harvest in Saskatchewan reached 2,510,000 m^3 of wood; at the next peak in 1988, 3,818,000 m^3 were cut. In 1993, the harvest reached 4,400,000 m^3. The size of the harvest is limited by the "allowed cut," a figure that is supposed to insure that the harvest is less than new growth and depletions from fire. In recent years, the harvest of white spruce and other softwoods (the most valuable trees in our forests) has exceeded 85% of the allowed cut, and a large part of the reserve supply is in inaccessible areas. Worse yet, regeneration failure has not been fully taken into account in setting the allowed cut. SERM's research shows that timber stocks will decline by about one-third over the next rotation of the harvest if management practices do not change.

We can expect industry to try to persuade us that harvest volumes can be maintained. They will likely argue that:

(1) There is room for conservation within the commercial zone without significant reduction in the allowed cut or land base available for the harvest by making minor changes in harvest methods.

(2) There is an excess of old forest at present. Representative old forest would be adequately protected by establishing reserves without changing the "rotation age" at which trees are cut or distribution of the harvest elsewhere.

(3) Even if the land base for the harvest is reduced to some extent, improved silviculture and intensive management can increase yields in the future, making substantial reduction in the allowed cut unnecessary.

These strategies may be compatible with the broad language used in the *Saskatchewan Long-term IFRM Plan,* but they would not sustain the boreal ecosystem as a functioning whole.

Measures such as wider "leave" strips about lakes and streams do not involve much expense, and do not significantly reduce the harvest. They can be accommodated within IFRM designed to maximize the timber harvest. But simple fixes like these may help maintain populations of some game animals, but they are not enough to preserve the complexity of the boreal ecosystem. In fact, there is good evidence that small leave strips may actually be detrimental. Birds nesting in leave strips are subject to high rates of predation. Predators concentrated in islands and strips of forest eliminate prey and begin to feed on one another. Unfortunately, it will not be easy to make room for more extensive changes in the harvest. If large buffers, small patterned cuts, and extensive stands of mature woodland are required, the land base for harvesting might be reduced, and the cost of harvesting increased.

It would be particularly difficult to preserve old spruce and spruce-fir forest in the commercial zone without major changes in harvesting methods. Some might be left in riparian buffers, but this would not provide the large blocks of intact forest necessary for many old forest denizens. We can expect proponents of minimized IFRM to advocate preserves as the principal solution to the old forest problem. The commercial zone would be insulated from the problem by segregating old forest in preserves. Preserves can play a useful role, but if old forest is relegated to them, the diversity of the forest as a whole is destroyed. If old forest is to play its role as a *refugia* for boreal wildlife, it must be dispersed throughout the forest in a natural pattern. Preserves all too easily become isolated "islands of extinction."

At present, intensive management is not an important part of forestry in Saskatchewan, but it has long been advocated by industry and government as a means of increasing yield. In the 1980s, there was interest in very large-scale intensive management: commercial forests would be managed like agricultural crops. Pure stands of commercially valuable, genetically improved trees would be planted and tended using fertilizers and herbicides (to "weed" undesirable hardwoods). Intensive management of a part of the commercial forest remains attractive to industry as a tradeoff that would allow cut limits to be preserved even if the land base for the harvest is reduced.

There are two serious objections to heavy reliance on intensive management. In the first place, an intensively managed forest is not a natural ecosystem. Biodiversity is inevitably decreased. Use of herbicides to "weed" stands is unacceptable, and not allowed in Saskatchewan at present. Herbicides risk contamination of the environment, but perhaps even more important, drastically alter natural vegetation. Aspen browse used by deer and other animals is reduced, for example. In Sweden, where intensive management has been practiced on a large scale since the late 1960s, significant declines in biodiversity and the extirpation of old forest plants and animals have been reported.

The second problem with intensive management is that it may not work. Early release of softwood by removing competing aspen has been tried in Saskatchewan, but with mixed results. In a controlled experiment in Nova Scotia, trees in thinned stands developed to merchantable size more quickly, but the total yield at optimal rotation age was higher in unthinned stands. Other studies in eastern Canada suggest that spruce and fir actually develop better with the protection of "competing" hardwoods than without it.

It is surprising that advocates of intensive management reject fears that herbicides have residual effects on wildlife because such effects have not been "scientifically proven," while advocating methods of yield improvement that are equally unproven. The paradox is perhaps explained by the fact that *promises* of improved yield, not actual *results*, are all that is required to argue that intensive management will sustain heavy harvesting and high cut limits.

Short of business as usual, the version of IFRM sketched above is a worst-case scenario for environmentalists. It can be hoped that industry will offer more to protect the boreal ecosystem. It is possible to do much better. A good model for environmentalists is an approach that has been called "natural forest landscape strategy (NFLS)." NFLS is based on maintaining the full range of natural forest ecosystems throughout the working forest:

"This approach is epitomized by 'a

lighter approach,' with more attention to natural regeneration and longer rotations for most of the land base. Management of all resources, including water quality, timber and habitats for all species will be included. Aesthetics would flow naturally out of good planning and cut block design. ... Clearcuts will be carried out, but in a range of sizes to emulate natural disturbance patterns. ... Within clearcut disturbance patches, forest ecosystems will be regenerated in size and pattern emulating natural systems."

This is not an unrealistic option. The proponents of NFLS argue that it is both an ecological and economic mistake to copy European intensive management in Canada:

"In Canada we have no shortage of land, a very sparse population, and slow growth rates which make for low returns on intensive silviculture at many sites. Forest landscape management requires more planning, a lower intensity of land use, but more total area in use. ... We have one of the few countries where such an extensive forest management approach makes economic sense. It maintains Canada's competitive position and yet is a 'green' approach."

But if we hope to see the new forest policy that effectively protects the boreal forest, we will have to work hard to get it. Environmentalists can no longer afford to advocate sustainable development in general, woolly terms. Industry will put the best face possible on its proposals for the future. If the debate does not go beyond slogans, the public will all too readily accept anything the industry offers under the banner of sustainable development. Environmentalists must be prepared to critically assess the industry's version of IFRM presented in EIAs and Forest Management Plans. As industry and government move from the general to the specific, so must environmentalists.

Further Reading

Canada Forest Service and SERM, Forestry Branch. 1995. Saskatchewan long-term integrated forest resource management plan.

GRISS, Paul. 1993. "Implementing sustainable forests: a Canadian commitment." *Forest Chronicle* 69:535.

OSBORNE, William. 1974. The paper plantation. Viking Books.

BOOTH, D.L., D.W.K. BOULTER, D.J. NEAVE, A.A. ROTHERHAM and D.A. WELSH. 1993. "Natural forest landscape management: a strategy for Canada." *Forest Chronicle* 69:141-145

The Prairie Rattlesnake is of considerable economic value to the farmer as it feeds on grain-destroying pests such as rats, mice and other small rodents. *Froom, Barbara. The Snakes of Canada.*

THE CANADIAN ENDANGERED SPECIES ACT — IMPORTANT LEGISLATION IN DANGER OF EXTINCTION?

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As we go to press, the whole process of passing federal endangered species legislation is in jeopardy. The plan called for public input and Nature Saskatchewan was spearheading a three-pronged approach with the Saskatoon and Regina clubs. We had developed a three-part presentation to be given at a meeting of the Standing Committee of the Environment in Edmonton, one of several meetings to be held across the country. The meeting was cancelled and re-instated several times before finally being cancelled. Apparently the Bloc Québécois is trying to affect other legislation and is using this Bill in its tactics. Our current (end of November) understanding is the government will try to push the Act through second reading and hold the meetings in late December 1996, January or February 1997.

On a more positive note, the Province has begun a process to add legislation to provide protection on provincial lands. Nature Saskatchewan is cooperating with SERM in this process, which should be complete by the summer of 1997.

The federal government's act to protect Canada's endangered wildlife was tabled in the House of Commons on 31 October 1996. What does this mean for Saskatchewan, the other prairie provinces and the rest of Canada?

The problem of species decline and threat of extinction was recognized years ago. The United States has had legislation since 1973, and, while it is not perfect, it has made a difference. Despite early fears the legislation has had little impact on development; of the "consultations" required by the U.S. Act, only about 2% have resulted in an impact on the development proposal. Mainly due to underfunding of recovery programs, the record for protecting the species is less impressive; 26 have become extinct. Four provinces, Manitoba, Ontario, Quebec and New Brunswick, have also passed legislation to protect endangered species, but again lack of action has limited their usefulness. Sheila Copps, as Environment Minister, in 1995 began the process to introduce a federal Endangered Species Act and the current minister, Sergio Marchi, has continued the work. During this period, naturalists have lobbied intensively, spearheaded by the Canadian Endangered Species Coalition (Canadian Nature Federation, Canadian Parks and Wilderness Society, Sierra Club, Sierra Legal Defence Fund and the Union Québécois pour la Conservation de la Faune). Their efforts have largely gone unheralded by the public and unnoticed by the media.

The basis for the new Act is a list prepared by a voluntary group of respected scientists called the

Committee on the Status of Endangered Wildlife In Canada (COSEWIC). The 1996 version of this list contains 264 Canadian species at risk, 19% mammals, 19% birds, 22% fish, 33% plants, and some other animals. Of this number, 57 species are considered endangered (that is, threatened with immediate extinction or extirpation). Nine species, including Great Auk, Passenger Pigeon and Labrador Duck are already extinct; lost forever. Of the 264, 29 species, including eight endangered, occur in Saskatchewan; 35, including 6 endangered in Manitoba; and 31, including six endangered, in Alberta.

Saskatchewan's endangered species include the Whooping Crane, with a current wild population of about 170 birds. The Eskimo Curlew, once numbered in the countless millions, is so rare that it was thought extinct. There was a recent possible sighting of this bird in Manitoba, reported in *Blue Jay*. The Burrowing Owl is now down to between 1000 and 1500 pairs in Canada. A recovery program, spearheaded by Nature Saskatchewan for the last eight years, that includes voluntary cooperation by landowners (Operation Burrowing Owl) to leave their nesting habitat intact, was started in 1987, but these birds are still losing ground. The Peregrine Falcon was decimated by the now banned pesticide, DDT. One pair from a captive breeding program now nests in downtown Saskatoon. The Piping Plover has suffered from changes in habitat and human disturbance. Fifty percent of the Canadian Piping Plover population nests in Saskatchewan and this year's census found an encouraging 1340 birds, up about 15% in five years. However, Margaret Skeel reports that the overall population is up by only 2% and believes that the Saskatchewan increase includes many immigrants. The Mountain Plover had one nest in 1987, and maybe one in 1991 in Saskatchewan. There is a recovery plan for Alberta, but not for Saskatchewan. There have only been seven recent records of Sage Thrasher. Our single endangered plant, the Slender Mouse-ear Cress, has no protection at all and now may be reduced to a few plants. The Bigmouth Buffalo fish, which lives in the Lake of the Prairies, is listed as vulnerable. Its habitat may be at risk, depending on the outcome of the current Upper Assiniboine River Basin Study. The Swift Fox was once eliminated (extirpated) from Canada by shooting, poisoning and habitat loss. A reintroduction of over 750 captive and wild-born Swift Foxes into Alberta and Saskatchewan has recently begun to show signs of success.

So what will the new Canadian Endangered Species Act (CESA) do for us? Sadly not nearly as much as we wanted. The good news is that Canada is finally passing a federal law to protect its species at risk. The Act includes most of the recommendations of the federal Endangered Species Task Force, although it falls short in some critical areas. Where it applies, it prohibits anyone from killing or harming a species at risk, or damaging its residence (we are not sure how to interpret "residence"). Extirpated species are not afforded this same protection, a major flaw in the Bill. Recovery plans are required within one year of listing for endangered species, and within two years of listing for threatened and extirpated species. Management plans for vulnerable species and their critical habitats are required within three years of listing. The most unwelcome aspect is that the minister and the cabinet have unbridled discretion about listing of endangered species.

COSEWIC will advise on listing, but cabinet will make the decisions.

Only about 40% of Canada's species at risk (aquatic species, most migratory birds, and species on federal lands) are protected from direct harassment by this Act. Even less, about 30% would be eligible for habitat protection under the Act. This is because habitat can be protected for aquatic species and those that live on federal lands, but not migratory birds or international transboundary species. Another drawback is that although habitat protection measures must be addressed in a recovery plan, these plans have no legal force. The government will decide what, if any, measures in a recovery plan will be implemented, including habitat protection. Also, if the Act is extended to cover species that cross national borders a further 20% of the species at risk would receive some coverage.

The Bill does not require advance review of projects that will affect species at risk, except where such review is already required under other federal legislation. The new legislation would be much stronger and more useful if it required an advance review of *all* projects identified as having the potential to affect an endangered species. The folly of not having an advanced review places the proponent at risk of contravening the Act and being subject to stiff penalties. It seems prudent to avoid that risk by having an advanced review.

A number of our species face persistent threats to survival and continue to decline, some more dramatically than others. Where COSEWIC finds that a species is in imminent danger, the minister may provide emergency protection, but is not required to do so. We cannot afford to lose a species and we cannot wait while the bureaucratic process unfolds. When a species is faced with extinction or extirpation, then we Canadians should expect immediate action from the minister. Exemption permits may be granted where harm to a species is minimized. But the Act allows a broad blanket exemption for any activity taken for the protection of national security, health and safety, including health and safety of plants or animals. What this means is not clear. The Act does allow a citizen to bring a private action into court when the government has failed to enforce the law. However, the citizen must wait for the government to complete an investigation of the matter first, even if there is an immediate threat to a species' survival.

Overall, the Bill authorizes the federal government to take the steps needed to protect Canada's species at risk (e.g., listing, habitat protection), but does not require that it do so.

COSEWIC lists 27 species at risk that are part of Saskatchewan's wildlife. Of these 27 only two (possibly three, if the Smooth Goosefoot occurs in the Dundurn Military camp) will gain any protection from the proposed legislation as it is currently written. About 80% of the Saskatchewan Black-tailed Prairie Dogs inhabit Grasslands National Park while the Wolverine occurs in Prince Albert National Park. The remaining species live outside lands under federal jurisdiction. The Bill also applies to federal crown corporations, including the PFRA and FCC. If these agencies, which own a substantial amount of land in the prairie zone, do not seek exemption from this Act, then they will contribute to species conservation. These we see as major weaknesses of the new Act

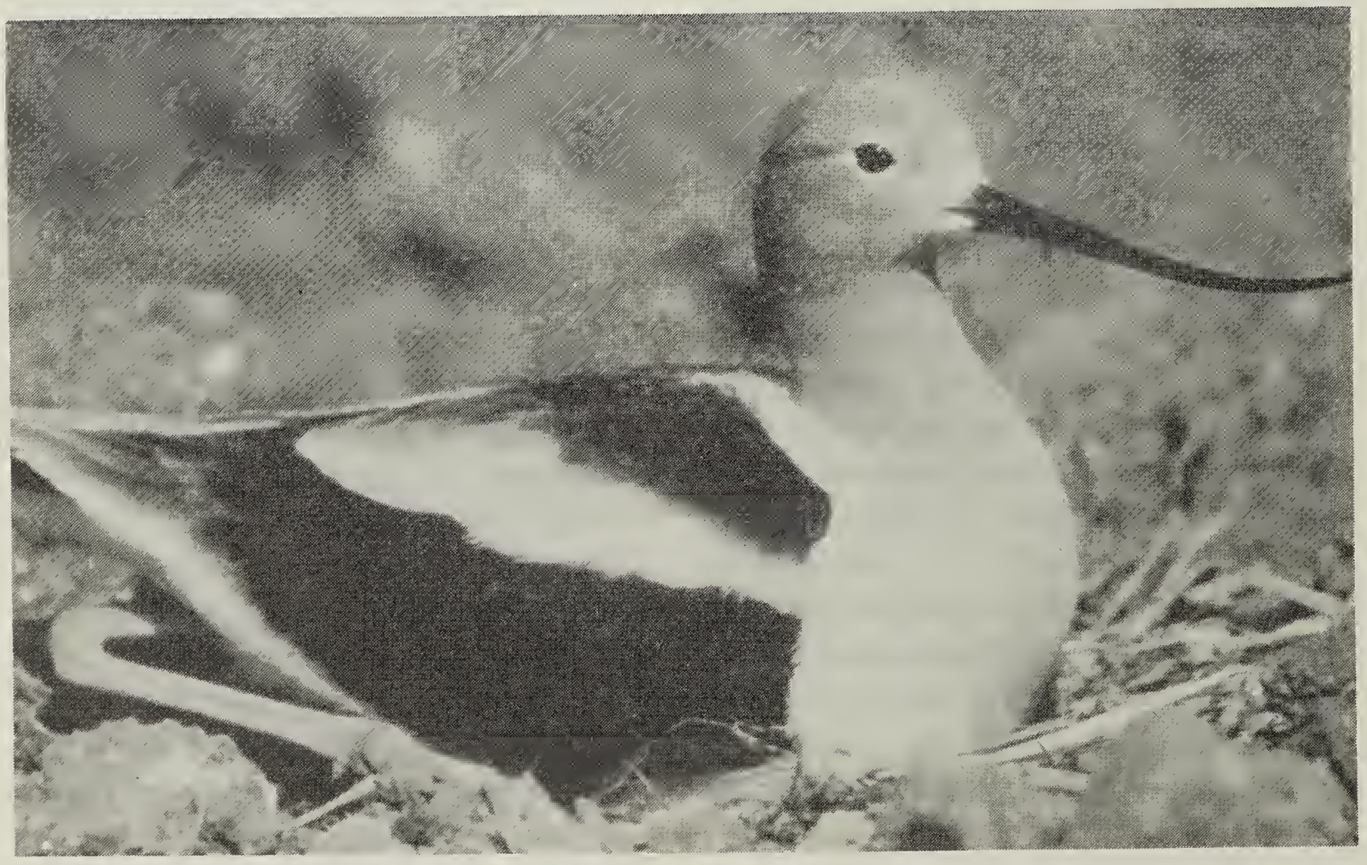
Eastern Short-horned Lizard — one of Saskatchewan's species at risk *Wayne Lynch*

and areas that must receive immediate attention. We recognize that under our constitution there are severe limitations imposed on the federal government to take unilateral action. We understand that wildlife has been interpreted by the courts as a "natural resource" and in the control of the provinces. Endangered species, in our view, transcend the narrow legal and political interpretations we use for jurisdictional issues and reach a level of national importance. The problem is best exemplified by the plight of the Whooping Crane. Although this extremely rare bird has enjoyed the benefits of more than 50 years of conservation effort, it still numbers only about 170 individuals. Because Whoopers breed mostly in Wood Buffalo National Park on federal land, their nesting area is largely protected. But about two-thirds of these birds migrate and stage in and around Saskatoon on private farmland. This is as critical a time as breeding, for the birds need to build up their reserves for the flight to Texas. While they are protected from direct threat by the terms of the Migratory Birds Convention Act (MBCA), they do not have full protection as endangered species. Projects and actions that could disrupt their passage south could not be stopped by the MBCA. Of the remaining 25 species not covered by CESA in Saskatchewan, nine, including Whooping Crane, receive some protection from the MBCA and four have blanket coverage by the Fisheries Act. Currently, then, there is some measure of federal protection for 48% of the species at risk in Saskatchewan. The CESA would extend this to 55%. The Bill does not extend protection to all migratory species, leaving a large taxonomic group known as raptors (birds of prey) out of the Act. In Saskatchewan this would mean that the Burrowing Owl and Ferruginous Hawks would not receive full protection under the Act. While our analysis was done for species found in Saskatchewan, it appears that these numbers are typical for the rest of the country. The Act has the potential to give a significant increase in protection to those that need it most, but, as written, it falls short of the needed coverage. We need a stronger CESA.

COSEWIC has already established a credible reputation nationally and internationally as a scientifically defensible body of recognized experts. It is to the federal government's credit that it has recognized the contribution made by the COSEWIC and will formalize its existence in CESA. There is an unnecessarily restrictive three-year limit on the term of office in COSEWIC. While having some turnover in the committee membership is essential, turnover for its own sake is not worthwhile. Also, the required regional representation is a political not a scientific criterion. The aims of CESA should be to protect wildlife not to provide political credits for committee appointments. Even non-Canadians should be eligible for membership.

The species at risk not fully covered by the discussion above are plants. In Saskatchewan we have five species of plants in need of protection, some unique to this province. The one endangered plant, Slender Mouse-ear Cress, mostly grows on farmland near the town of Lucky Lake. Most of the animal species are in difficulty because of habitat destruction. With plants this is doubly true, as they are bound to a fixed locality by their dependence on specific growing conditions. Lack of habitat protection, one key weakness with this bill, is particularly evident when considering this province's plants.

These are some of the comments generated about CESA so far. Nature Saskatchewan and its affiliates will be continuing their work to improve the value of this bill for those that need it most: our endangered species.



American Avocet *Andrius Valadka*

NOTES AND LETTERS

GREAT GRAY OWL — GRAY SQUIRREL ENCOUNTER

About noon on 29 February 1996, Douglas spotted a Great Gray Owl flapping around our back garden, trying to grab a Gray Squirrel off one of the trees by the rear chain-link fence. The squirrel escaped through the fence and hid under a couple of scrub fir trees. Blundering through the lower branches, the owl attempted to grab the squirrel, which again escaped. This time it nipped across the rear neighbour's lot to a steel wheelbarrow propped up against a tree. The squirrel then hunkered down between the wheelbarrow and the trunk of the tree, while the owl perched on top of the wheelbarrow's handle. After 45 minutes and with the squirrel still in hiding, the owl flew 10 feet away to perch on a stump. At this point a couple of Blue Jays started to harass the owl, but it just ignored them. After a further half hour or so, the squirrel headed off towards the neighbour's side gate. At once, the owl gave chase and after a lot of flapping it seized the squirrel, then dragged its heavy burden back under the fir tree by our fence. There it sat on the squirrel, killed it and began to feed on it.

We were amazed next morning (1 March) to find the owl still in position on top of his meal. Throughout the day, despite visits by numerous friends and neighbours who came by to see our unusual visitor, the owl continued to feed on the squirrel. During these proceedings, other Gray Squirrels kept coming around to berate the owl, when they were not chasing each other. Not very bright squirrels! By 1800 hours, the owl, seemingly unconcerned about all the interest it had stirred up in this peaceful neighbourhood, finally took off.

The next morning, while eating breakfast, Doug happened to glance towards our neighbour's crab apple tree, and there, on a stump, sat the owl. Before we could take a picture, it flew away. We saw it fly over twice more before it disappeared for good. Later, a number of birders came by, hoping to see the owl, but the only trace was the picked-over carcass of the squirrel. Since Great Gray Owls rarely occur in Winnipeg, and seldom prey on Gray Squirrels, this was our highlight of the year.

- ALINE AND DOUGLAS LUDLOW, 77 Sandra Bay, Winnipeg, MB. R3T 0J9

Great Gray Owl "sitting" on carcass of Gray Squirrel *Aline and Douglas Ludlow*

NATURE LIBRARY

BIRDS OF THE BESNARD LAKE AREA, NORTH-CENTRAL SASKATCHEWAN, 1968-1994

JON M. GERRARD, GARY R. BORTOLOTTI, KAREN L. WIEBE. Special Publication No. 20, SNHS. No. 2, Manley Callin Series. 97pp. 1996.

The tenth SNHS regional bird publication is a welcome addition to the Society's tradition of detailed accounts of the birds of various parts of the province. The authors — all trained scientific researchers — have not allowed the rigorous bounds of the scientific method to restrict their evident enthusiasm as naturalists. Their anecdotes and comments illuminate and invigorate their descriptions of the birds of a formerly little-known part of the province.

The book has an interesting history, arising out of a long-term study of Bald Eagles initiated by John Gerrard and Doug Whitfield in 1967. That study has had many participants, including Gary Bortolotti whose Ph.D. studies contributed much to it, and its results have been widely published (notably in Gerrard and Bortolotti's book *The Bald Eagle: Haunts and Habits of a Wilderness Monarch*, published by the Smithsonian Institution in 1988). Fortunately for Saskatchewan, Gary Bortolotti remained in the province, and began his own long-term study (of American Kestrels) in the Besnard Lake area. The third author, Karen Wiebe, studied Kestrels with Gary for her Ph.D. and has contributed much to the science of the book apart from her delightful line drawings; there are only eight of these and more would have been welcome. Clearly the authors and their collaborators (among whom they give particular credit to Doug Whitfield) have kept careful notes far beyond those required for their research, perhaps with this book in mind but perhaps just because they are keen and observant naturalists. These notes have allowed them to assemble a comprehensive account of over 200 species of this fascinating part of the southern belt of the western boreal forest.

The book begins with a characteristically sweeping and quantitative Foreword by Stuart Houston (who tells us, among other things, exactly how many papers each author has published). Brief biographies of the authors are followed by a description of the study area and its history, geology, soils, vegetation, and climate. Throughout, photographs of habitats and localities illustrate the rich ecological diversity of this area, which may surprise many whose image of the province is of flat wheatfields and rolling grasslands. The authors draw attention to the recent increase in logging in the area, to the much more comprehensive removal of tree cover by current forestry practices compared with former ones, and to the critical role of fire in the forest's ecology, exemplified by the enormous fire which burned for six weeks in 1995 and consumed part of the study area. One can only hope that the authors, if not others, will be able to continue bird counts and observations to document the effects of these changes on the avifauna.

The status of many — perhaps most — of the entries in the Species Accounts is derived from observations made incidentally in the course of research and travel. As one would expect, the relative amounts of information on different groups of birds reflect the research projects of the authors. Bald Eagles are best studied from the water, and waterbirds are thoroughly documented. Only the raptors encountered during the kestrel studies are described in comparable detail. Shorebirds and, particularly, small songbirds, are mostly listed with only a line or two of information. This is particularly disappointing because there are some fascinating nuggets here that deserve further study: Bay-breasted Warblers, for example, have not been recorded in the last 17 years, and there is only one record of Golden-crowned Kinglet. The authors did carry out owl censuses and forest-bird transects in a commendable effort to lessen their dependence on observations made during their focused research projects, but one is left wondering whether some of the anomalies in the passerine records might still reflect the inevitable biases of the field work.

That said, the information on water birds and raptors is comprehensive and fascinating. Clearly the region is of exceptional interest in the contrast of aquatic habitat types between the two halves of Besnard Lake, and in the abundance of piscivorous species. The benefit to kestrels of the opening up of the forest by logging roads is well documented, as is the surprising abundance of Boreal Owls that Bortolotti discovered during his research. It is refreshing to read of a bird fauna dominated by long-term increases in abundance, or stable populations, rather than peppered with references to population declines! However there is a warning in the discussion of the increases in fish-eating birds, likely due to overfishing of the larger predatory fish, allowing increases in abundance of the smaller "forage" fish on which many of these birds feed. As fishermen become more aware of declines in their primary target species, they will likely blame the birds for it, as has happened so widely elsewhere on this continent. Naturalists will need to be on their guard for the inevitable demands for "control" of fish-eating birds by fishermen unwilling to accept responsibility for their own intemperate behaviour.

This is a fascinating book which succeeds admirably in presenting solid information in a palatable and interesting style. The authors are particularly to be congratulated for retaining and communicating their underlying enthusiasm for natural history, which remains the essential foundation to the rigorous science for which the authors are already well known.

- Reviewed by *Tony Diamond*, Director, Atlantic Cooperative Wildlife Ecology Research Network, UNB, Fredericton, NB

BRITISH COLUMBIA — A NATURAL HISTORY

RICHARD CANNINGS and SYDNEY CANNINGS. 1996. Greystone Books, Douglas & McIntyre, Vancouver. 320 pages, 7 1/2" x 10", $45.00 cloth.

If Christmas money is burning a hole in your pocket, or if you have been wondering what to get your sister Mary for her birthday, here is the perfect answer. The book is about the natural history of B.C. but, as I leafed through this handsome volume, among the first of the many gorgeous colour pictures to catch my eye were two of familiar prairie species. The first is a larger-than-full-page shot of a Yellow-headed Blackbird perched among exploding cattail seed heads; the other is a stunning double page photograph of a clump of Prickly Pear Cactus blossoms. The Cannings' latest book may be about Canada's west coast province, but it contains much to interest people of the Great Plains as well as anywhere else in the country. For those who, like myself, maintain a long-distance love affair with B.C., interspersed with more intimate visits, it is a genuine delight.

The Preface declares that the book "is intended to provide an introduction to the ecosystems of the province and to tempt readers to learn and explore more by offering a few intriguing, in-depth stories about life in those ecosystems." The authors fulfil their intention admirably well. Although I didn't need much tempting, the book led me through many new doors into fascinating rooms where I look forward to spending more time in study.

As you go through the book you will read about hot-blooded lizards, snuggling winter kinglets, long-nosed grasshoppers, illuminated bacteria, self-propelling plants, lungless salamanders, and algae that live inside sea anemones. You will also be intrigued by how mosquitoes find us, how mistletoes spit seeds, how sunspots affect snowshoe hares, how barnacles make love, and how water in some trees can reach a temperature of -40° before freezing.

The text is sprinkled with wonderfully descriptive imagery:

"Great geological forces have created the giant canvas we call B.C., but it is painted by the Pacific."

"A shoreline is ... a wall between two worlds. Along seacoasts, tides are like a swinging door in this wall, bringing the sea onto the land and then extending the land into the sea."

"If you look closely you can see an American Dipper a grey tennis ball of a bird nervously doing knee bends on the polished rocks."

Seeing in the Preface that each chapter stands on its own, I read the chapter on the Grasslands first. While the grasslands of B.C. have their own unique character, there is a great deal in this chapter to which prairie people can relate. Then I read the one on The Spruce Kingdom. The latter has much of interest for those who love Canada's vast boreal forest. There are other chapters devoted to particular ecosystems: the coastal waters of the Pacific, the rain forests, mountaintops, montane forests and fresh water worlds. The first three chapters set the context, dealing with geological history and the influence of the ocean and the ice ages on B.C.'s geography and biology.

My only criticism of the book is that the most demanding material is in these initial chapters. I found my mind wandering from time-to-time as I read them. Although there is some logic to this organization of content, and while the Preface suggests starting wherever one wishes, I can't help feeling that the authors might have been wiser to choose some other strategy. Don't let this deter you from buying the book, however.

It is a beautiful volume. For the most part it reads well, gripping your attention. There are many fascinating things to learn from it. It contains 130 full-colour photographs — almost forty of them a page or double page in size — and twenty-five maps. Numerous line drawings of plant and animal species appear as sidebars and make the book useful as a field guide. Interesting quotations are inserted in the text at appropriate points. There is a bibliography and a list of environmental organizations, as well as an index. And if you are concerned about what human beings are doing to the natural world, you will appreciate the Epilogue with its strong appeal for the protection of ecosystems and its call for environmental action.

British Columbia — A Natural History is a volume I am happy to have on my shelf. I suspect that whoever receives it as a gift, whether it is your sister Mary or yourself, will feel the same.

- Reviewed by *Garth Nelson*, 529 Dalhousie Crescent, Saskatoon, SK. S7H 3S5

RECENT OBSERVATIONS

A Varied Thrush was reported from Edam, northwest of the Battlefords on 1 December and one was seen at Weyburn (25 November). Another was seen earlier at Kindersley (1 October). A Hawk Owl was reported from Edam on 30 November, while another seen in the Qu'Appelle Valley (23 November) was possibly the same one observed earlier, closer to Regina (19 November). Another interesting owl, a Boreal, was seen at Regina Beach (20 November). A Black-backed Woodpecker was observed in Saskatoon (19 November) and a late lingering Spotted Towhee was there on 16 November. A weak Common Eider, picked up near Riceton, subsequently died (18 November). Another Common Eider was seen on Last Mountain Lake (16 November). Three Common and two King Eiders were seen at Regina Beach (9 November), but this was reduced to one Common and two King for the 10 and 11 November. On 12 November a Common Eider was viewed on Blackstrap Reservoir. A dark phase Gyrfalcon, 3 White Pelicans, all three mergansers and 14 Bald Eagles were at Gardiner Dam on 12 November. A Gyrfalcon was also seen earlier at Regina Beach (2 November). Short-eared Owls were seen to the north, south and in the middle of Saskatoon during November. Snowy Owls were reported from several locations in the province. A SNS trip to Cypress Hills netted a Mountain Chickadee, a Three-toed Woodpecker, many eagles and some large groups of Pronghorn. A Pomarine Jaeger was identified at Regina Beach (11 November) and may have been the unidentified jaeger seen earlier at the same location (7 November). An Oldsquaw and the first Northern Shrike of the season were seen at Blackstrap on 5 November. A Pacific Loon turned up on Last Mountain Lake (28 October) and a surprisingly early Yellow-billed Loon was reported from Saskatchewan Landing Provincial Park (22 September). Snowy Owls were initially reported from several locations in the province, but by the end of November were scarce. The intense cold and higher-than-normal snowfall may have driven them farther south.

NATURE SASKATCHEWAN NEWS

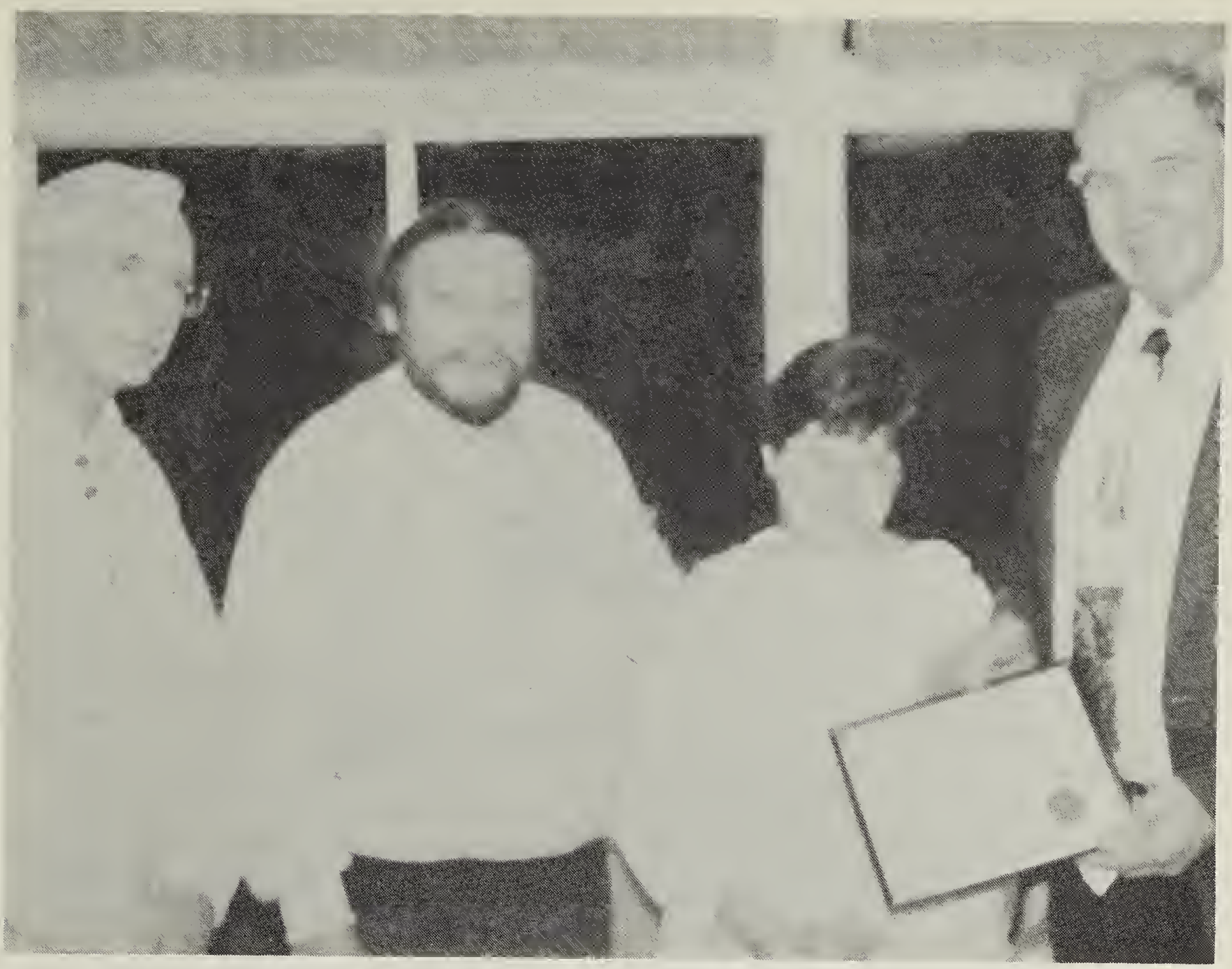
FALL MEET '96

This year the Fall Membership meeting for 1996 was held at Camp Rayner, on the west shore of Lake Diefenbaker, near Birsay. A total of 71 members were in attendance. The annual event began with socializing and browsing through the Blue Jay Bookshop. The evening entertainment, as usual, was the Larry Morgotch slide competition which was won by Garth Nelson. The business meeting agenda included the usual reports from directors and staff, resolutions, and election of officers and directors. There were presentations to our members from the Saskatchewan Wetlands Conservation Corporation on the Remnant Prairie Program and from the Royal Saskatchewan Museum (Robert Kreba) on the Life Sciences Gallery progress.

Much of Saturday afternoon was spent soliciting input from members on reviewing Nature Saskatchewan's strategic plan. Based on comments from the conference evaluation this session was much appreciated. Members do take a strong interest in the organization and it clearly showed. The Board will be taking this information and using it to update the strategic and annual operating plans. Many thought this should be done on a regular basis.

After a delicious banquet meal, certain individuals were honoured for their accomplishments and commitment to Nature Saskatchewan's goals. The Conservation Award went to Peter and Sharon Butala of Claydon for their contribution to the preservation of shortgrass prairie (Old Man on his Back Shortgrass Prairie and Heritage Preserve), Fellow

Bernie De Vries (r) receives the award of Fellows from President Robert Berthiaume.



Peter and Sharon Butala (r) receive Nature Saskatchewan's prestigious Conservation Award from President Robert Berthiaume and Conservation Director Garth Nelson (l).

Ronald Jensen (l) receives Nature Saskatchewan's Fellow Award from President Robert Berthiaume.

Dr. Vernon Harms receives Fellow's Award from President Robert Berthiaume.

Garth Nelson (r) receives the Larry Morgotch Award for best slide presentation on Friday evening.

Awards went to Bernard De Vries, Bernie Gollop, Frank Switzer, Ronald Jensen and Dr. Vernon Harms, the Larry Morgotch Award went to Garth Nelson for his entertaining slides on Friday evening, the Cliff Shaw award went to Peter Taylor for the best article in *Blue Jay* during the last 12 months (March 1996), and the Volunteer of the Year award went to Mary Gilliland for her outstanding contribution as special publications editor in completing three Manley Callin Series Publications in the Spring of '96.

To all award recipients, congratulations!

As usual, Frank Roy gave us a delightful slide show of the "Elbow" after the banquet. His excellent slides and commentary are also reflected in his recently published book, *Birds of the Elbow*. The next day, Sunday, was spent touring the Luck Lake Heritage Marsh with Frank Roy as our guide. Thanks Frank, for all the trouble and effort you made to attend the Fall Meet. It was appreciated by all.

MURIEL CARLSON WINS THE 1996 PARKS CANADA AWARD

The federal government publically honours Canadians who, by their achievements, have made a significant contribution to conserving our heritage. In 1996 Muriel Carlson was one of the recipients and the citation for her award reads:

"The personal efforts of Muriel Carlson in preserving Saskatchewan's natural and cultural heritage demonstrate one individual's effectiveness in heritage stewardship. As an archaeologist and amateur naturalist, she realized the unique features of a 50-hectare site beside Turtle Lake in northwest Saskatchewan,

Mrs. Muriel Carlson, member of Nature Saskatchewan, accepts the 1996 Parks Canada Award from Deputy Prime Minister and Minister of Canadian Heritage, Sheila Copps, assisted by Mr. Tom Lee, Assistant Deputy Minister, Parks Canada.

the site of her summer cottage. She, (along with her friend, E.M.Robinson, who lives at the Lodge nearby) convinced local residents of the need to preserve this area, then lobbied the provincial government and persuaded Nature Saskatchewan to purchase the property to establish a nature sanctuary. In less than a year, she raised double the amount of funds necessary to purchase the property. The nature sanctuary now preserves a diverse population of flora and fauna and such rare and delicate species as the Franklin's Lady Slipper (one of eight orchid species found there). Muriel Carlson's work is characterized by her technical skills and enthusiasm. She is a dedicated birder and has also recorded over 300 archaeological sites (including those on the sanctuary). A volunteer at Saskatoon's Wanuskewin Heritage Park, she has revived, and is teaching others, the long-forgotten techniques of First Nations pottery, thus preserving for future generations these ancient clay-firing methods. Her continuing preservation of Saskatchewan's archaeological heritage and tireless devotion to her Nature Sanctuary benefit all Canadians."

The remaining land parcels that contain nine acres along the shoreline have now been purchased so that work can proceed with trails and signage in the spring. A fund is also in place to pay the taxes in perpetuity. Donations and memorial bequests are welcome. A checklist of the birds and self-guiding tour brochures are also available.

Muriel and her husband enjoyed a weekend in Calgary, sharing the award event with the families of the 10 other winners from across Canada. Parks Canada officials took them to the Bar U Ranch in the foothills, then to Banff for the presentation by Hon. Sheila Copps. The final banquet in Calgary at a Heritage Home served some of the most delicious western and northern food.

Muriel said this was definitely one of the most memorable occasions in her life and she felt humble when she heard the stories of the other winners: a dedication to nature and culture was part of them all. Muriel is thankful to Stuart Houston and Jim Hay of the Saskatoon Nature Society and all those who supported her nomination.

INTERNATIONAL OWL SYMPOSIUM

ROBERT NERO
Department of Natural Resources, Winnipeg, MB

The Second International Symposium: Biology and Conservation of Owls of the Northern Hemisphere will be held on 5 to 9 February 1997 at the Delta Winnipeg Hotel, Winnipeg, MB. It will include scientific papers, workshops, field trips, exhibits and films. All are welcome! Phone (204) 945-6817 or 7465 for information.

SASKATCHEWAN NATURAL HISTORY SOCIETY
[Statement of financial activities and fund balance for the year ending March 31, 1996, with comparative figures for 1995 (7 months)]

Income	Operating Fund	Trust Fund	Managed Fund	Total 1996	Total 1995
Sask Lotteries	95,800	—	—	95,800	60,000
Conservation program	—	—	—	—	2,241
Education	—	—	—	—	10
Endangered species/spaces	—	—	—	—	691
Specified programs (schedule 1)	96,041	—	—	96,041	11,406
Self generated (schedule 2)	49,298	—	—	49,298	35,939
Other revenue (schedule 3)	49,890	—	—	49,890	21,848
Trust fund - net (schedule 4)	—	(12,812)	—	(12,812)	(6,483)
Managed fund (schedule 5)	—	—	268,406	268,406	67,048
Total	**$291,029**	**$(12,812)**	**$268,406**	**$546,623**	**$192,700**
Expenses					
Administration (schedule 6)	95,256	—	—	95,256	62,842
Travel and meetings (schedule 7)	2,873	—	—	2,873	5,410
Communications (schedule 8)	28,995	—	—	28,995	25,618
Programs (schedule 9)	157,324	—	—	157,324	36,696
Other expenses (schedule 10)	5,783	—	—	5,783	4,583
Managed funds	—	—	268,406	268,406	67,048
Total	**$290,231**	—	**$268,406**	**$558,637**	**$202,197**
Net income (gross)	798	(12,812)	—	(12,014)	(9,497)
Fund balance, beginning of year	22,821	292,905	—	315,726	325,223
Fund balance, end of year (retained earnings)	**$23,619**	**$280,093**	—	**$303,712**	**$315,726**

Lesser Golden Plover *G.W. Beyersbergen*

SASKATCHEWAN NATURAL HISTORY SOCIETY
Balance sheet for twelve months ending March 31, 1996

Assets	Operating Fund	Trust Fund	Managed Fund	Total 1996	Total 1995
Cash and short-term deposits	89,288	60,461	—	149,749	122,527
Accounts receivable	13,914	—	—	13,914	15,751
Inventory - Bookshop	19,504	—	—	19,504	13,956
Prepaid expenses	350	—	—	350	—
Marketable securities (quoted market value $257,079; 1994 - $249,451)	—	240,039	—	240,039	249,817
Capital (note 4)	50,536	—	—	50,536	50,536
Interfund receivable (payable)	20,110	(20,407)	297	—	—
Total	**$193,702**	**$280,093**	**$297**	**$474,092**	**$452,587**
Liabilities and Fund Balances					
Accounts payable and accrued liabilities	37,697	—	—	37,697	10,505
Deferred amounts funding (note 5)	48,565	—	—	48,565	11,577
Restricted					
Open (schedule 1a)	25,925	—	—	25,925	23,943
Closed (schedule 1b)	7,360	—	—	7,360	7,874
Managed (schedule 5)	—	—	297	297	32,427
Total	**$119,547**	**—**	**$297**	**$119,844**	**$86,326**
Fund balances (schedule 4 - trust fund)	23,619	280,093	—	303,712	315,725
Equity in capital assets	50,536	—	—	50,536	50,536
Total	**$193,702**	**$280,093**	**$297**	**$474,092**	**$452,587**

Fireweed *Gary Anweiler*

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